Structure Geotechnical Report
Ramp 7TH-A Retaining Wall Structure Number 081-6013

I-74 Iowa to Illinois Corridor Study
FAI Route 74
Section 81-1-2
Station 625+40.24 to 634+99.66
Rock Island County, Illinois
P-92-032-01
Contract No. ______

Prepared for

Illinois Department of Transportation
Division of Highways
2300 S. Dirksen Parkway
Springfield, Illinois 62764

Prepared by

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1 Introduction

The purpose of this Structure Geotechnical Report (SGR) is to summarize the preliminary structural and geotechnical recommendations for retaining wall 081-6013, which is a part of the I-74 Iowa to Illinois Corridor Study. Currently it is proposed that 081-6013 be constructed immediately east of proposed Ramp 7^{TH}-A, between Stations 625+40.24 and 634+99.66. A plan view of the wall alignment is presented on the Soil Boring Layout diagram in Appendix A. A subsurface cross-section is provided in Appendix B.

This report includes evaluation of suitable retaining wall systems with regards to in-situ soils, existing structures and utilities, and the proposed construction staging. In addition, preliminary global stability and wall lateral deflection analyses were performed for the recommended preliminary wall type to verify design and construction feasibility. A summary of results for the preliminary analyses is presented in Table 1.

The project involves relocating the I-74 Bridge spanning the Mississippi River. The project also includes the construction of approximately 13,000 feet of approach roadway on the south (Illinois) side of the river. Additionally, several access ramps and associated retaining walls will be constructed to accommodate the construction of the proposed bridge and roadways.

1.1 Proposed Structure Information

Retaining wall 081-6013 is a hybrid wall, meaning that a section of wall can retain combined cut plus fill. The wall will retain between 3 and 16 feet of soil between Stations 625+40.24 and 634+99.66. Of these 16 feet, 11 feet are in cut and the other 5 feet are in fill. The wall will replace part of the existing 2H to 1V slope, thereby, allowing more space to accommodate the proposed improvements. The 2H to 1V backslope extends from top of the wall up to about elevation 660 feet. The total length of the wall is 925 feet.

The small amount of fill is proposed to flatten the existing slope behind the wall. The added fill will help to slow and reduce runoff and debris movement downslope toward the roadway, and provide a more aesthetically blended view with respect to the flatter natural slope above. Fill heights required to provide the flattened slope are up to 5 feet thick.

1.2 Assumptions

The preliminary analyses presented in this report were developed based on the following assumptions and limitations.

- The suitability of the wall type recommended in this report is based on the currently proposed alignment and available cross sections and is likely to change if significant changes in the alignment occur.
- Recommendations are presented based on the latest construction staging, scheduling, and maintenance of traffic (MOT) plans[1]. The recommendations will need to be reviewed if changes are made to the plans.

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[1] "I-74 Corridor Study Preliminary Plans – Illinois 90% Preliminary Plans," prepared for the Illinois Department of Transportation, CH2M HILL, Inc., September 2007

1.3 Existing Information and Site Description

This report is based on subsurface information obtained from Phase 1A (completed in 2005) and recently completed Phase 1B. No other previous subsurface information was available at the time of this report. Since wall 081-6013 is not a replacement wall but rather a new wall, existing structure information is not applicable.

The site of the proposed wall alignment is currently vacant land. Based on a review of the Soil Boring Layout Diagram (included in Appendix A), the existing ground surface elevations varying from about 588 to 630 feet NAVD-88[2]. Ground surface elevations noted in boreholes drilled along this alignment as a part of the investigation varied from 591.1 to 630.1 feet.

2 Subsurface Explorations and Conditions

2.1 Subsurface Explorations

The subsurface exploration programs consisted of advancing eight boreholes (ILR0402, ILR0404, ILR0407, ILR0408, ILR0409, RW1105, RW1108, and RW1102) along the proposed wall alignment. Additionally, borehole ILR0403 was performed at the top of the hill to obtain information of the soils to be retained. RW1105, RW1108, and RW1102 were drilled during Phase 1A (around November, 2005). Boreholes ILR0402, ILR0403, ILR0404, ILR0407, ILR0408 and ILR0409 were drilled during recently completed Phase 1B. The borings were drilled by Terracon Inc., under subcontract to CH2M HILL. All the borings were performed under the direct supervision of CH2M HILL geotechnical engineer or geologist.

The borings were advanced to depths ranging from 26.5 to 50 feet below ground surface (bgs). The boring termination elevations vary from about 595 to 556. The boreholes were typically advanced to their termination depths using hollow-stem augers. Standard penetration tests (SPT) were performed in general accordance with ASTM D1586 using automatic hammers. Soil sampling was generally performed at 2-foot and 5-foot intervals. A limited number of thin-walled tube (Shelby tube) samples were retrieved in cohesive soils, in general accordance with ASTM D1587. Auger refusal was encountered in borings ILR0402 and RW1108. Rock coring was not performed in any of the borings.

Laboratory tests were performed on select soil samples to verify field classifications and to determine engineering properties. The laboratory analyses consisted of moisture content, Atterberg limits, hydrometer and consolidated undrained (CU) triaxial compression test. The CU triaxial compression test was performed on a relatively undisturbed sample obtained from boring RW1105. The laboratory test results are provided in Appendix D.

2.2 Generalized Subsurface Conditions

2.2.1 Soil Conditions

Based on a review of available subsurface information, soils along the backslope, behind the proposed retaining wall, and underneath the wall generally consisted of native soil overlying apparent bedrock (based on auger refusal).

[2] Unless noted otherwise, all elevations in this report are positive, in units of feet, and with respect to NAVD-88 datum.

Native soil consisted of a variable mixture of gravel, sand, silt, and clay, which can be geologically classified as till. The till extends to apparent bedrock, which was encountered at depths between 36 to 38 feet bgs. In general, the till was encountered between elevations 645 and 555 feet. The consistency of the till was typically in the medium stiff to very stiff range. In a few borings, medium dense sand lenses were found within the till layer. No cobbles or boulders were identified in the till layer. Apparent bedrock was hit (based on auger refusal) in borings ILR0402 and RW1108, at elevations ranging from 555 to 556 feet, respectively. It should be noted that contamination was not encountered in any of the borings.

2.2.2 Groundwater

Groundwater was noted in borings ILR0402, ILR0404 and ILR0408 at elevations ranging from 583 to 604 feet. The groundwater observations were made right after drilling completion. Note that the borings drilled along the alignment in this exploration encountered predominantly fine-grained soils, typically silt, clayey silt, and silty clay. Such soils have low hydraulic conductivities and require significant time periods to equilibrate. Therefore, the above-referenced groundwater table should not be considered representative of existing groundwater conditions.

Groundwater level fluctuations may occur over time, depending on several factors, including precipitation, evaporation, surface runoff. Given the distance from the Mississippi River, we do not anticipate the river elevation to significantly impact the static groundwater table. Groundwater issues with regard to 081-6013 are discussed in Section 5.

3 Retaining Wall Type Evaluation

3.1 Appropriate Wall Types for 081-6013

Since the entire wall will be for retaining cut and no groundwater cut-off is anticipated, the following three retaining wall systems are considered the most suitable for 081-6013.

3.1.1 Anchored soldier pile and lagging wall with cast-in-place (CIP) permanent concrete facing

The soldier pile and lagging system has two basic components: (1) soldier pile (also referred to as the "shaft" or "post") and (2) lagging. Soldier piles are usually set at 6- to 10-foot spacing and are typically designed to carry the full earth pressure load. The lagging usually spans the distance between the soldier piles and is typically designed to resist relatively minor earth pressure loads. Initial lagging is most commonly timber, but may also consist of light steel sheeting or corrugated guardrail sections.

Soldier piles are installed either by drilling or by driving into the bearing strata, the former being the most commonly used method. For the drilled-in option, a hole is drilled from the ground surface down to the design tip elevation at a constant horizontal spacing along the wall length. The soldier pile is then placed in the center of the hole and the hole is grouted using lean concrete mix. After the grout has set around the soldier piles, the soil is excavated in front of the piles down to the final grade. As the excavation proceeds, timber lagging (or planks) are installed between the soldier piles to support the cut face. Typically, in sandy soils the excavated unsupported soil height is limited to only 2 feet. The drilled-in soldier pile option can be used with precast lagging or with cast-in place permanent concrete facing as the final lagging.

A risk associated with this type of wall is the raveling of soil due to the saturated sand and gravel seams. Additionally, dewatering prior to the excavation may induce settlement of nearby structures and underground utilities and slow down the construction daily production rates. Considering the potential corrosion of the soldier piles and deterioration of the lagging during the 75-year service life, the CIP facing has to be designed to withstand the full long-term earth pressure load, which will result in an increased concrete thickness and consequently increased cost and reduced daily production rate. Depending on the ground conditions, the soldier pile and lagging wall can be cantilevered to height up to 16 feet without surcharge or backslope. If a surcharge load is applied behind the wall the cantilevered height is reduced to up to 12 feet. For higher heights, the soldier pile and lagging system is combined with tie-back anchors.

3.1.2 Anchored sheet pile wall with CIP concrete facing

Sheet pile walls are built by driving, vibrating or pushing interlocking steel sheet pile sections into the ground. The risk associated with this wall type is the vibrations induced during the installation of the sheet piles, which may adversely impact existing utilities and structures. Considering the potential corrosion of sheet piles during the 75-year service life, the CIP facing is designed to withstand the full long-term earth pressure load, which will result in an increased concrete thickness and consequently increased cost and reduced daily production rate. Additionally, in some locations sheet pile driving may not be feasible because of the high blow counts or shallow bedrock. The sheet pile wall can be cantilevered up to 16 feet without surcharge and up to 12 feet with a surcharge load applied behind the wall depending on the ground conditions.

3.1.3 Soil nailing wall with CIP concrete facing

This type of wall is constructed by excavating an initial cut to a depth slightly below the first row of nails, typically about 3 to 6 feet depending on the ability of the soil to stand unsupported for a minimum period of 24 to 48 hours. Nail holes are drilled at predetermined locations to a specified length and inclination. The nails are inserted into the hole and the drillhole is filled with cement grout. Following placement of the shotcrete, a steel bearing plate and securing nut are placed at each nail head and the nut is hand wrench tightened sufficiently to embed the plate a small distance into the still plastic shotcrete.

The most desirable subsurface conditions for soil nailing are where the soil exhibits good stand up time (i.e., it can stand near vertical over 3 to 5 feet in height for a minimum of 24 hours) and where groundwater is minimal or can be easily controlled. Other factors that should be considered in the selection of soil nailing walls include soil strength, wall geometry (such as right of way availability), and allowable wall deflection criteria. The most significant risks associated with this wall type are the stand up time of the soil, and potential for raveling ground where saturated seams of sands and gravel are encountered. Other risks such as handling large exposed face of shotcrete in cold weather can be mitigated by using covers, but these measures can reduce production rate and increase costs. Typically, the nails are 0.8 H to 1.0 H long for walls with no surcharge loads.

3.2 Evaluation of Subsurface Conditions and Recommendation

The cut wall types mentioned in Section 3.1 were evaluated based on existing soil and groundwater conditions. Among the evaluated wall types Anchored Soldier Pile and Lagging Wall with Permanent CIP Concrete Facing is considered the most suitable alternative for 081-6013 due to the following constructability issues:

- As presented in Section 2.2, the existing soils consist of heterogeneous native soils (till). Driving of sheet piles in very stiff till could be very difficult. A sheet pile section is relatively weaker and more flexible than a soldier pile. Therefore, the risk associated with structural damage during driving operations is higher for sheet piles than soldier piles. In addition, soldier piles could be installed by pre-drilling, eliminating the need of pile driving operations and consequently the risk of structural damage. For these reasons the use of a sheet pile wall is not recommended for 081-6013.

- Considering that up to 5 feet of fill is proposed to flatten the existing slope behind the wall, the soil nailing wall with CIP concrete facing alternative is not considered suitable. Because soil nails are installed into existing material, the soil nail wall facing would be the wall element required to retain any fill placed above it. Structural facing support for the lateral soil load from fill heights greater than a foot or two is generally not an efficient mean of support. However, fill can be placed behind a soldier pile wall that has been constructed taller than the existing retained soil height. For this reason, the use of a soil nailing wall is not recommended for 081-6013.

4 Geotechnical Analyses of the Recommended Wall System

4.1 Lateral Load and Global Stability Analysis of 081-6013

Preliminary lateral load and global stability analysis were performed on models developed using available subsurface data and geometry from proposed cross sections. The analyses were made based on geometry at Station 632+00.00 (critical section). At this Station the final exposed height (after construction) of the wall is approximately 16 feet (maximum final exposed height along the entire wall) with a 2H to 1V backslope. It should be noted that during construction the maximum exposed height of the wall increases to about 19 feet, considering 2 feet of embedment of the permanent concrete facing and 1 feet for installation of the drainage aggregate, per Illinois DOT bridge design manual.

Lateral load analysis indicates that at least one row of anchors is required at wall 081-6013 when the final exposed height exceeds 7 feet. The distance between the top of the wall and the location of the first anchor should be approximately 1/3 of the maximum exposed height reached during construction. For the segment of the wall with anchors, a maximum exposed height (occurring during construction) to pile embedment depth ratio (H/D) of 1.0 is recommended to minimize the lateral deflection of the wall. The H/D for the portions of the wall in cantilever (no-anchors) should be about 1.6 (based on the maximum exposed height during construction as well).

The deflections at the top of the wall are estimated to be less than 1 percent of the maximum exposed height occurring during construction. An anchor load of approximately 95 kips was estimated from the analysis. Based on preliminary design information, the soldier piles are not intended to carry any vertical load (other than self-weight and vertical load component from the anchor, which is relatively small assuming an anchor inclination of 15 degrees with respect to the horizontal). Hence, if later design refinements require the piles to carry a vertical load, axial load capacity evaluations should be performed to confirm the adequacy of the recommended pile embedment depth.

Global stability analysis was performed using SLIDE software version 5.0 (Rocscience, Inc., 2007). Long term (drained) and short term (undrained) conditions were evaluated. The undrained soil shear strength parameters were conservatively assumed based on correlations with N-values from standard penetration tests. The drained soil shear strength parameters were derived from a CU triaxial compression test performed on a relatively undisturbed sample obtained from boring RW1105.

The most critical global stability condition was obtained based on short term (undrained) conditions. The model for this critical condition considers the maximum exposed height of 19 feet obtained during construction. The minimum factor of safety against global stability, following Bishop's Method, is 1.2. The pinning and stabilizing effect of the soldier piles, as recommended by FHWA[3], was not included (conservative) in the analyses. It should be noted that this minimum factor of safety of 1.2 happens only during construction of the wall. Permanent conditions demonstrate factors of safety of at least 1.5. Therefore, global stability is considered adequate at wall 081-6013.

TABLE 1 - SUMMARY OF PRELIMINARY LATERAL LOAD AND GLOBAL STABILITY ANALYSIS FOR 081-6013 STA 631+00.00

Final Maximum Exposed Height =	16	feet
Backslope =	2H to 1V	
Spacing between Soldier Piles =	6.5	feet
Soldier Pile Steel Section =	14x72	H-Piles
Estimated Wall Maximum Deflection =	1.2	inches (at top of wall)
Estimated Anchor Force =	95	kips
Anchor inclination angle =	15	degrees (with respect to the horizontal)
Estimated Total Anchor Length =	35	feet
Factor of Safety Global Stability Circular[1] =	1.52	long term (drained) conditions
Factor of Safety Global Stability Circular[1] =	1.20	short term (undrained) conditions
Factor of Safety Global Stability Block[2] =	1.55	long term (drained) conditions
Factor of Safety Global Stability Block[2] =	1.20	short term (undrained) conditions

[1]Circular failure mode.
[2]Block failure mode.

4.2 Lateral Earth Pressure

Based on subsurface conditions at 081-6013, the lateral earth pressures presented in Table 2 should be used in designing the segments of the wall that can be constructed in cantilever (no anchors). The lateral earth pressures in Table 2 are presented as an equivalent fluid pressure. This equivalent fluid pressure accounts for the buoyant unit weight of the soil factored by the relevant earth pressure coefficient.

TABLE 2 – LATERAL EARTH PRESSURE

Condition	Equivalent Fluid Pressure Above GWT (psf/foot of depth)	Equivalent Fluid Pressure Below GWT (psf/foot of depth)
Active	65	95
Passive	330	220

For the design of the anchored soldier pile and lagging system the use of apparent earth pressure following FHWA[3] Guidelines is recommended.

4.3 Seismic Considerations

Based on the American Association of State Highway and Transportation Officials (AASHTO) seismic coefficient map, the southern 1/3 of Illinois is the most seismically active portion of the state. In the northwestern portion of the state, near the location of the proposed retaining wall, the horizontal bedrock accelerations are 0.03g to 0.035g. At these accelerations, seismic analysis for the wall does not need to be performed.

[3] FHWA (1999). *Geotechnical Engineering Circular No. 4; Ground Anchors and Anchored Systems.* FHWA-IF-99-015.

4.4 Mining Activities

A review of the Illinois State Geologic Survey (ISGS) maps indicates no past mining activities in the area of the proposed retaining wall 081-6013.

5 Preliminary Construction Considerations

5.1 Construction Considerations

The preliminary construction considerations presented below are based upon the limitation, construction staging, scheduling, and maintenance of traffic (MOT) plans as discussed in Section 1.2.

As described in Section 1.1, 081-6013 will comprise both cut plus fill earth retention. Therefore, the soldier pile and lagging wall will need to be constructed taller than the existing ground height. The following general construction sequence is recommended for 081-6013:

1. Pre-drill and place soldier piles into the ground.
2. Install the timber lagging from top of the wall to existing ground surface.
3. Place and compact the proposed fill behind the wall.
4. Continue installing the lagging and anchors, as the excavation progresses.
5. Once the lagging and anchors installation is completed, install CIP permanent concrete facing.

5.1.1 Soldier Pile Installation

Soldier piles are installed either by drilling or by driving into the bearing strata. Based on subsurface conditions, hard driving conditions are anticipated. In addition to potential pile damage, these conditions frequently result in poor control over soldier pile and wall alignment. Therefore, pre-drilling is recommended for installation of the soldier piles.

A brief description of the drilled-in method was presented in Section 3.1.1. Due to lack of reliable groundwater information along the proposed wall alignment, definitive recommendations related to concrete placement methodology can not be provided at this time. Piezometers should be installed during the final design subsurface investigation program in order to obtain more accurate groundwater readings and readings with time. If the groundwater table elevation is found below the tip elevation of the soldier pile, a dry concrete placement methodology can be used. Alternatively, if the groundwater can not be controlled the use of wet placement methods by either a tremie pipe or conventional pumping techniques is recommended.

5.1.2 Fill Placement behind Wall

One construction issue for this wall is placement and compaction of fill behind the wall. To prevent high lateral earth pressure loads and excessive deflection, it is recommended that the fill behind the wall consist of predominately granular material with less than 10 percent silt or clay sized particles by weight. To limit loading due to compaction of fill soil, it is further recommended that hand-operated equipment such as a jumping jack or plate compactor be used to compact the fill within 5 feet of the back of the wall.

5.1.3 Anchor Testing

Testing the anchors is recommended by the anchor installation contractor to demonstrate that design capacities have been achieved. The testing of anchors includes two different types of tests: (1) performance tests; and (2) proof tests.

1. Performance Test: The performance tests are intended to verify the tieback anchor capacity, establish the load-deformation behavior of the anchor, identify the causes of the anchor movement, and to verify that the anchor free length is equal to or grater than the one assumed in the anchor design. The performance test involves a cyclically and incrementally loading and unloading schedule, with a holding period at the maximum load applied during the last loading-unloading cycle.

2. Proof Test: The proof test involves only a single load cycle and a load hold at the test load. The proof test provides a means of evaluating the acceptability of anchors that are performance tested. Where the proof test shows a significant different load-deformation behavior from the performance test, an additional performance test is recommended on the next adjacent anchors. The design load transfer values for the proof test on each anchor should be determined during the final design.

5.1.4 Drainage

A drainage system is recommended to prevent hydrostatic pressure from forming behind the wall. A drainage system should maintain gravity flow of water to outside of the anchored soldier pile and lagging wall. One way of achieving this is by installing a longitudinal pipe underdrain system connected to weep holes in the wall facing. Filter aggregate and/or an appropriate geosynthetic should be installed to minimize intrusion of material into the drainage system.

A drainage swale will likely be required behind the top of the wall to direct surface water flowing on the backslope away from the wall. Due to the large backslope and length of the wall, drop inlets and/or armoring may be required to avoid erosion of the soil behind the wall. In addition, there is a likelihood that water runoff from the steep backslope could overtop the wall. The free falling of the water from top of wall could also create erosion of the wall base. Therefore, erosion control design of both the top and base of the wall should be accommodated during final design.

5.1.5 Groundwater Control

As mentioned in section 5.1.1, piezometers installation is highly recommended to facilitate the final design process and lower the risk of encountering unknown groundwater conditions during construction. Any surface runoff, groundwater or perched water that accumulates in the bottom of any excavation related to construction of 081-6013 should be diverted by trenching to a low sump, and there pumped out by sump pump. Water pumped from excavation sumps should be discharged into a temporary sedimentation or pumped to an approved storm drain. The contractor should comply with local and all federal and state regulations.

5.2 Construction Monitoring

Due to the extensive backslope, it is recommended that in addition to the usual optical survey monitoring, a slope inclinometer be installed at mid slope. A qualified geotechnical engineer should be on site during construction of the wall. The engineer's duties should include installation, maintenance, daily reading acquisition, data interpretation, and daily communication with the design engineer.

Given the size and number of retaining walls and embankments on this project, and the correspondingly large number of instruments that require daily readings, it is recommended from a cost and quality perspective that a project-wide automated internet-based monitoring system be installed. Such a system can automatically collect and record data readings at specified intervals and/or based on movement criteria, and can be downloaded on demand (pinged).

5.3 Utilities

A utility review was performed in the area of retaining wall 081-6013 by CH2M HILL and presented in a technical memorandum[4]. That review does not identify any utility conflicts along the proposed retaining wall 081-6013. However, potential utility conflicts were identified during preparation of this report. The identified conflicts are based upon the drawings included in the above-mentioned technical memorandum.

An underground storm sewer utility was identified running along the proposed wall alignment between STA 625+40.24 and 631+50.00. Relocation or replacement of this utility line in conflict is recommended to facilitate construction of wall 081-6013. Details of relocation or replacement should be addressed at the earliest stages of IL-RW10 final design. Assuming that the conflicted utility is relocated away from wall 081-6013, we do not anticipate the proposed construction affecting future utilities. Any existing utility pipe that is abandoned should be filled out with grout or flowable fill.

Future utility impact study should be performed during final design to determine potential conflicts with utilities that were not covered as part of the preliminary design study. Therefore, utility conflicts with wall 081-6013 should be re-evaluated during final design. The evaluation should be focused in potential conflicts between utilities and structural elements associated with the wall such as soldier piles, lagging and anchors.

[4] "CH2M HILL Draft Technical Memorandum, I-74 Corridor (Iowa-Illinois) Study – Summary of Potential Utility Conflicts for Proposed Improvements in the Illinois Portion," prepared for the Illinois Department of Transportation, September 24, 2007

Appendix A
Soil Boring Layout and Wall Profile Diagram

Benchmark:
Chiseled "X" in Base of Traffic Light at Southeast Corner of Intersection of 19th Street and 7th Avenue.
Elevation NAVD 88 = 589.227

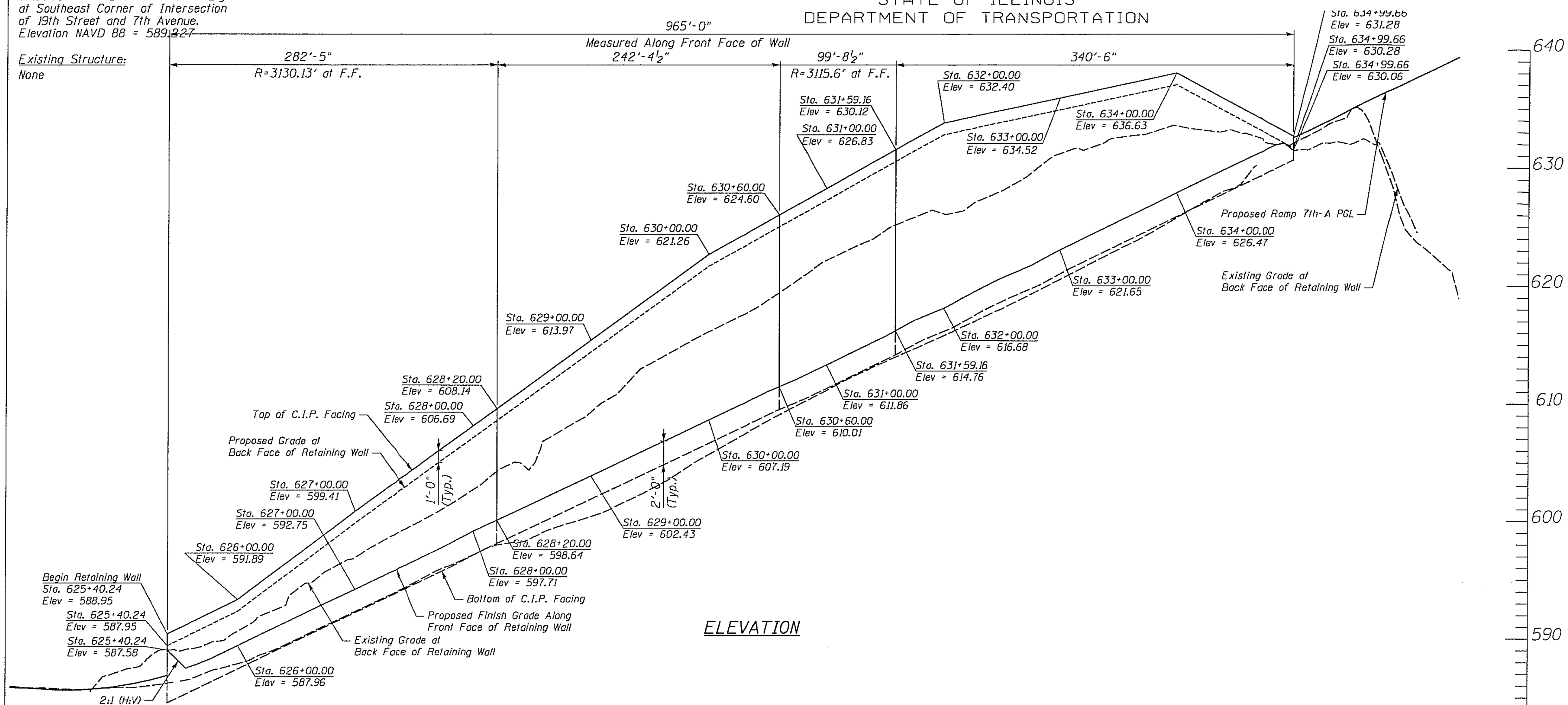
Existing Structure:
None

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

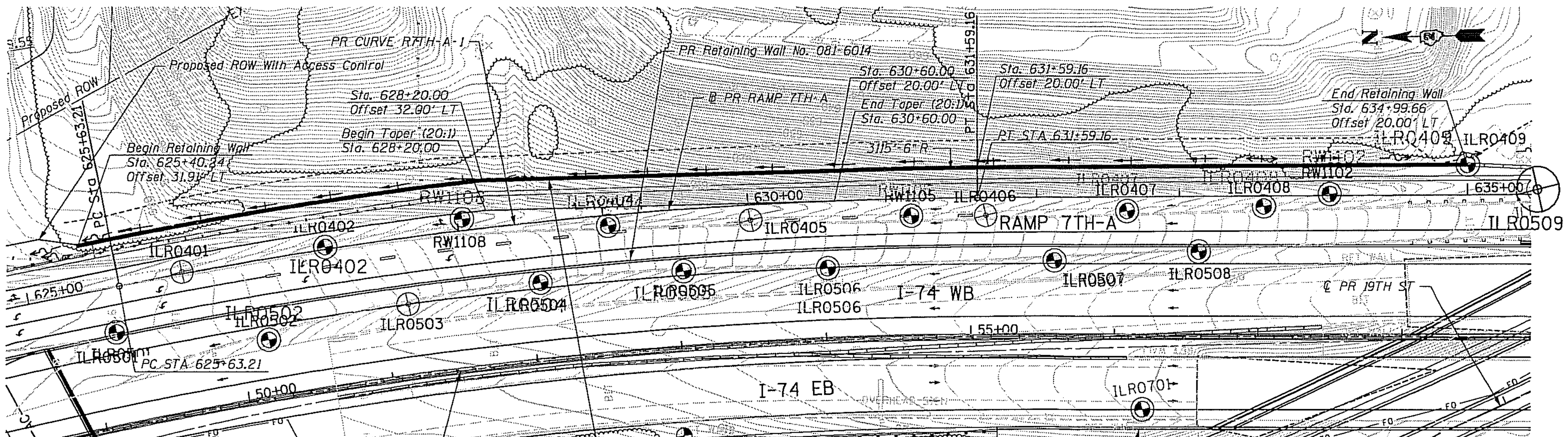
ROUTE NO.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
74	81-1-2	Rock Island		
FED. ROAD DIST. NO. 7		ILLINOIS	FED. AID PROJECT-	

SHEET NO. 1
3 SHEETS

Contract #



ELEVATION



PR CURVE R7TH-A-1
PI STA = 628+62.11
Δ = 11° 01' 50" (RT)
D = 1° 51' 03"
R = 3,095.50'
T = 298.90'
L = 595.95'
E = 14.40'
e = N/C
PC STA = 625+63.21
PT STA = 631+59.16

PLAN

HORZ SCALE: 0 50' 100'
VERT SCALE: 0 5' 10'

LEGEND

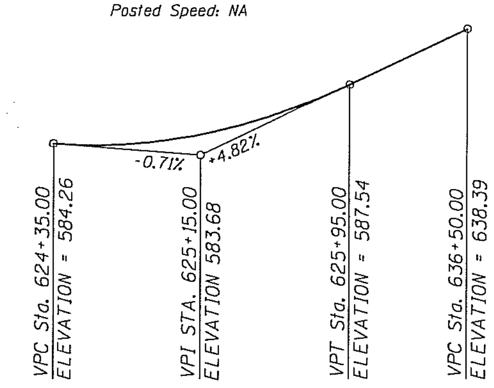
⊕ ◉ Soil Borings

Notes:
1. Wall stations and offsets are given to the front face (FF) of the wall and are measured from Ramp 7TH-A baseline.
2. See Sheet 2 for pile and joint information.

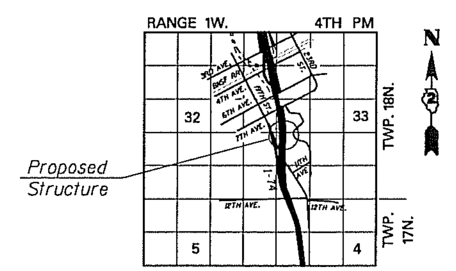
DESIGN SPECIFICATIONS
2002 AASHTO
Standard Specifications for Highway Bridges

DESIGN STRESSES
FIELD UNITS
f'_c = 3,500 psi
f_y = 60,000 psi (reinforcement)

HIGHWAY CLASSIFICATION
F.A.I. Route 74
Functional Class: Interstate FAI
ADT: 56,600 (2000); 81,900 (2035)
ADTT: 2830 (2000); 4100 (2035)
DHV: 5900 (2035)
Design Speed: 60 m.p.h.
Posted Speed: 55 m.p.h.
Ramp 7TH-A
Functional Class: Ramp
ADT: 5125 (2000); 6450 (2035)
ADTT: 260 (2000); 325 (2035)
DHV: 1000 (2035)
Design Speed: 50 m.p.h.
Posted Speed: NA



PROFILE GRADE
(Along ℄ Ramp 7TH-A)



LOCATION SKETCH

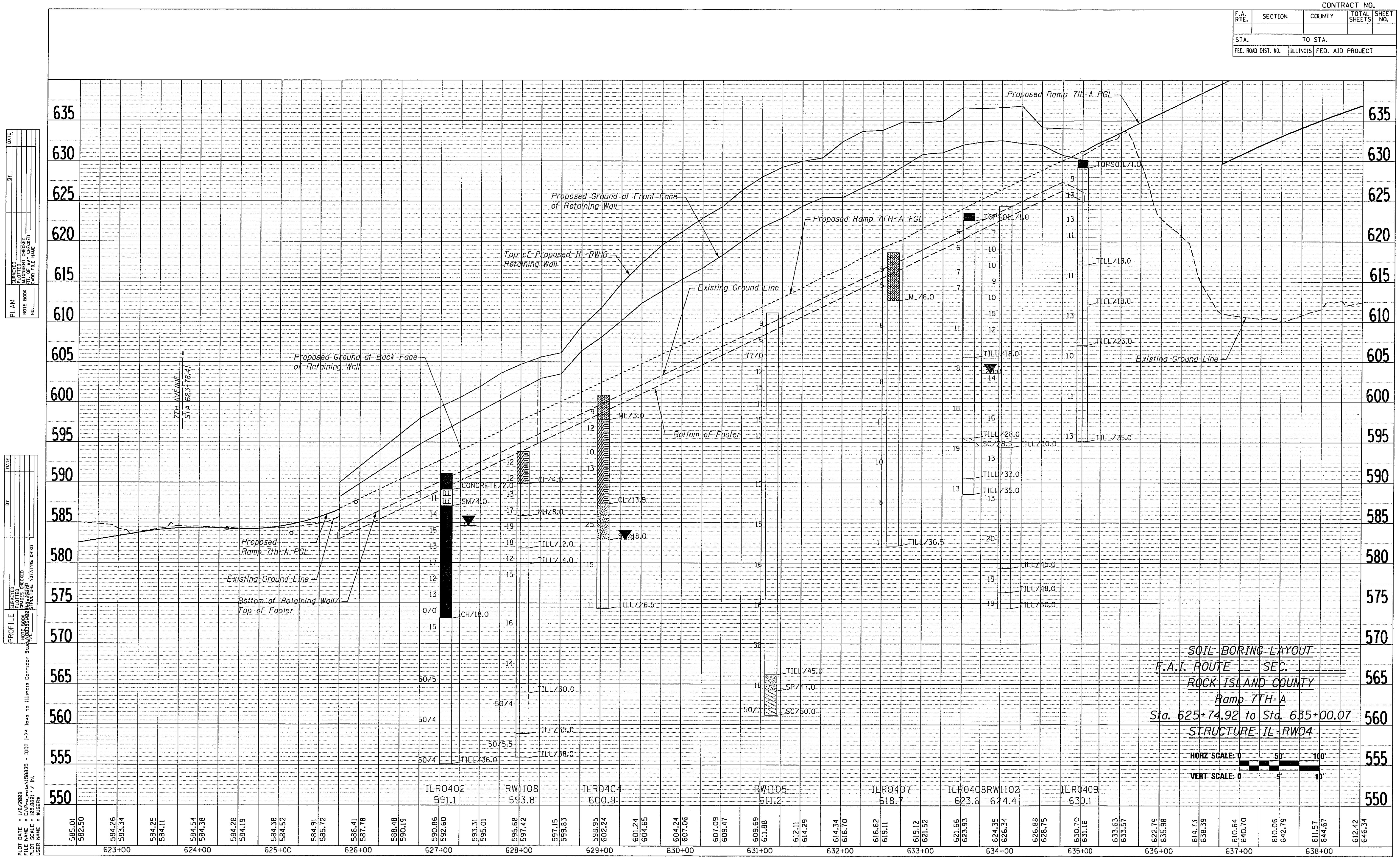
DESIGNED	- ECM
CHECKED	- KSM
DRAWN	- ALS
CHECKED	- KSM

- 200

EXAMINED
ENGINEER OF BRIDGE DESIGN
PASSED
ENGINEER OF BRIDGES AND STRUCTURES

SOIL BORING LAYOUT
F.A.I. ROUTE 74 SEC. 81-1-2
ROCK ISLAND COUNTY
RAMP 7TH-A Sta. 625+40.24 to Sta. 634+99.66
STRUCTURE No. 081-6013

Appendix B
Subsurface Cross-Section


CONTRACT NO.
F.A. RTE.
SECTION
COUNTY
TOTAL SHEETS
SHEET NO.
STA.
TO STA.
FED. ROAD DIST. NO.
ILLINOIS
FED. AID PROJECT
SOIL BORING LAYOUT
F.A.I. ROUTE __ SEC. ________
ROCK ISLAND COUNTY
Ramp 7TH-A
Sta. 625+74.92 to Sta. 635+00.07
STRUCTURE IL-RW04
HORZ SCALE: 0 50' 100'
VERT SCALE: 0 5' 10'
Proposed Ramp 7th-A PGL
Proposed Ground at Front Face of Retaining Wall
Top of Proposed IL-RW6 Retaining Wall
Proposed Ramp 7TH-A PGL
Existing Ground Line
Proposed Ground at Back Face of Retaining Wall
Bottom of Footer
7TH AVENUE STA 623+78.41
Proposed Ramp 7th-A PGL
Existing Ground Line
Bottom of Retaining Wall/ Top of Footer
ILR0402 591.1
RW1108 593.8
ILR0404 600.9
RW1105 611.2
ILR0407 618.7
ILR0408 623.6
RW1102 624.4
ILR0409 630.1
CONCRETE/2.0
SM/4.0
CH/18.0
TILL/36.0
CL/4.0
MH/8.0
TILL/12.0
TILL/14.0
TILL/30.0
TILL/35.0
TILL/38.0
ML/3.0
CL/13.5
TILL/26.5
TILL/45.0
SP/47.0
SC/50.0
ML/6.0
TILL/36.5
TOPSOIL/1.0
TILL/18.0
TILL/28.0
SC/28.5
TILL/30.0
TILL/33.0
TILL/35.0
TILL/45.0
TILL/48.0
TILL/50.0
TOPSOIL/1.0
TILL/13.0
TILL/18.0
TILL/23.0
TILL/35.0
623+00
624+00
625+00
626+00
627+00
628+00
629+00
630+00
631+00
632+00
633+00
634+00
635+00
636+00
637+00
638+00
PLAN
PROFILE
PLOT DATE
FILE NAME
PLOT SCALE
USER NAME

Appendix C
Soil Boring Logs

Illinois Department of Transportation

Division of Highways
CH2M HILL

SOIL BORING LOG

Date 9/20/07

ROUTE I-74 DESCRIPTION New I-74 Bridge Over Mississippi River - Illinois Approach LOGGED BY KB

SECTION I-74 Bridge over Mississippi River LOCATION (N=562799.18, E=2459788.941), SEC. 32, TWP. 18N, RNG. 1W, 4th PM

COUNTY Rock Island DRILLING METHOD HSA, CME 55 HAMMER TYPE CME AUTOMATIC

STRUCT. NO. ______
Station ______

BORING NO. ILR0402
Station ______
Offset ______
Ground Surface Elev. 591.11 ft

Surface Water Elev. ______ ft
Stream Bed Elev. ______ ft

Groundwater Elev.:
First Encounter 584.6 ft ▼
Upon Completion ______ ft
After ______ Hrs. ______ ft

Description	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Concrete And Subbase				
589.11				
Silty Sand(SM) dark brown, slightly moist, loose, fine to coarse grained, low plasticity, Dark brown, slightly moist, loose, fine to coarse sand, low plasticity fines		3		
		6		
		5		
587.11		4		
Clay (CH) dark grey, slightly moist, stiff, fine to medium grained, low plasticity, Darky grey, slightly stiff, low plasticity, trace fine to medium sand Rimac: Pu = 91 lbs	-5	5	1.7	
		9		
▼		2		
Same as above, thin poorly graded sand (SP) layer at top of sample		7	2.5	
		8	P	
Same as above, no sand Rimac: Pu = 105 lbs		3		
		5	2.0	
		8		
dark grey, slightly moist, very stiff, moderate plasticity, Dark grey, slightly moist, moderate plasticity	-10	4		
		8		
		9		
stiff, Same as above, stiff Rimac: Pu = 106 lbs		4		
		5	2.0	
		7		
		3		
	-15	5		
		8		
573.11				
Sandy Clay(CL) dark grey, wet, stiff, fine to medium grained, moderate plasticity		4		
		7		
		8		
	-20			

Description	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Sandy Clay(CL) dark grey, wet, stiff, fine to medium grained, moderate plasticity *(continued)* Dark grey, wet, stiff, moderate plasticity, fine to medium sand				
	-25			
No recovery from 25ft to end of drilling		50/5"		
	-30	50/4"		
	-35	50/4"		
555.11				
End of Boring				
	-40			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation

Division of Highways
CH2M HILL

SOIL BORING LOG

Date 10/8/07

ROUTE I-74 DESCRIPTION New I-74 Bridge Over Mississippi River - Illinois Approach LOGGED BY Bose, Kaustav/SCO

SECTION I-74 Bridge over Mississippi River LOCATION (N=562604.366, E=2459800.312), SEC. 32, TWP. 18N, RNG. 1W, 4th PM

COUNTY Rock Island DRILLING METHOD HSA, CME 55 HAMMER TYPE CME AUTOMATIC

STRUCT. NO. ______
Station ______

BORING NO. ILR0404
Station ______
Offset ______
Ground Surface Elev. 600.85 ft

Surface Water Elev. ______ ft
Stream Bed Elev. ______ ft

Groundwater Elev.:
First Encounter 582.9 ft ▼
Upon Completion ______ ft
After ______ Hrs. ______ ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Silt With Some Sand(ML) grey, slightly moist, stiff, fine to coarse grained, low plasticity			3		
			5	2.5	
			4	P	
Clay With Trace Sand(CL) grey, slightly moist, stiff, fine grained, low plasticity, broken gravel in tip RIMAC : Pu = 65lb (shear)	597.85		3		
			3	3.9	
			9	S	
		-5			
trace coarse sand, broken wood chips, no gravel			2		
			4	2.5	
			6	P	
no wood chips			2		
			4	3.0	
			9	P	
		-10			
Poorly Graded Sand With Trace Fines (SP) dark grey, wet, dense, fine to coarse grained, low plasticity, trace fine angular gravel, less than 1 inch	587.35				
		-15	2		
			10		
			15		
Sandy Clay(CL) dark grey, moist, stiff, fine to medium grained, low plasticity	582.85 ▼				
		-20			
Sandy Clay(CL) dark grey, moist, stiff, fine to medium grained, low plasticity *(continued)*			3		
			5	2.5	
			10	P	
		-25	1		
			6	6.6	
			5	S	
End of Boring	574.35				
		-30			
		-35			
		-40			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways
CH2M HILL

SOIL BORING LOG

Date 10/8/07

ROUTE I-74 DESCRIPTION New I-74 Bridge Over Mississippi River - Illinois Approach LOGGED BY KB

SECTION I-74 Bridge over Mississippi River LOCATION (N=562244.587, E=2459804.221), SEC. 32, TWP. 18N, RNG. 1W, 4th PM

COUNTY Rock Island DRILLING METHOD HSA, CME 55 HAMMER TYPE CME AUTOMATIC

STRUCT. NO. ______
Station ______

BORING NO. ILR0407
Station ______
Offset ______
Ground Surface Elev. 618.66 ft

Surface Water Elev. ______ ft
Stream Bed Elev. ______ ft

Groundwater Elev.:
First Encounter ______ ft
Upon Completion ______ ft
After ______ Hrs. ______ ft

Description	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Silt (ML) dark gray, firm, fine to medium grained, moderate plasticity		2 3 2	1.5 P		Clay (CL) dark gray, moist, firm, fine to medium grained, trace of angular gravel; <½ inch *(continued)* stiff		2 4 7	2.5 P	
trace of angular gravel; <½ inch RIMAC: Pu = 35lbs, shear		2 2 3	2.1 S						
	-5					-25	2 5 5	2.5 P	
612.66 Clay (CL) dark gray, moist, firm, fine to medium grained, trace of angular gravel; <½ inch		2 3 4	1.0 P						
		2 3 3	2.0 P						
	-10				very stiff	-30	1 4 4	2.0 P	
no sand or gravel observed RIMAC: Pu = 63lbs, shear	-15	2 3 5	3.8 S		very stiff RIMAC: Pu = 82lbs, shear 582.16	-35	1 5 6	4.9 S	
					End of Boring				
	-20					-40			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways
CH2M HILL

SOIL BORING LOG

Date 10/8/07

ROUTE I-74 DESCRIPTION New I-74 Bridge Over Mississippi River - Illinois Approach LOGGED BY F. Abreu

SECTION I-74 Bridge over Mississippi River LOCATION (N=562149.5231, E=2459805.768), SEC. 32, TWP. 18N, RNG. 1W, 4th PM

COUNTY Rock Island DRILLING METHOD HSA, CME 55 HAMMER TYPE CME AUTOMATIC

STRUCT. NO. ______
Station ______

BORING NO. ILR0408
Station ______
Offset ______
Ground Surface Elev. 623.59 ft

Surface Water Elev. ______ ft
Stream Bed Elev. ______ ft

Groundwater Elev.:
First Encounter 603.6 ft ▼
Upon Completion ______ ft
After ____ Hrs. ______ ft

Description	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Sandy Silt With Clay brown, moist, non plastic (622.59)				
Lean Clay Trace Grave(CL) olive gray, dry to moist, low plasticity, medium stiff, mottled with dark brown, few coarse to fine sands, trace medium to fine sibangular to subrounded gravels, possible native soil, gumbotil		2 3 3 4	2.8 P	
olive gray with brown, dry to moist, low to medium plasticity, medium stiff, occasional very angular gravel sized coal strands scattered throughout, possible glacial till Rimac: 3.125"-2.375", Pu = 65 lbs, shear	-5	2 2 4 5	1.2 S	
uniform olive gray, dry to moist, medium stiff, moderately cemented, unweathered glacial till		2 3 4 5	4.0 P	
uniform greenish gray to olive gray, medium stiff, moist, medium plasticity, unweathered glacial till Rimac: 2.672"-1.937", Pu = 58 lbs, shear	-10	2 3 4 5	1.1 S	
uniform olive gray, moist to dry, strongly cemented, 3" gray sandy silt, moist to wet, lense at center of sample, silt with fine sands, possible glacial till with sand lenses/seams (605.59)	-15	2 6 5 6	3.5 P	
	-20 ▼	2 2 6 6	1.2 S	
Lean Clay With Sand(CL) uniform olive gray, moist to dry, medium plasticity, stiff, little to few coarse to fine sands, trace medium to fine gravels, small dark green fine sand pockets in middle of sample, possible glacial till with sand pockets Rimac: 2.625"-2.000", Pu = 65 lbs, shear *(continued)*				
uniform olive gray, moist to dry, very stiff, little to few coarse to fine sands, top half some fine sands with silt, moist to wet, possible glacial till with alternating sand seams/layers (595.59)	-25	2 9 9 10	3.0 P	
Clayey Sand With Sil(SC) (595.09) uniform olive gray, very stiff, moist to wet, loose to medium dense, medium to fine sands with clay and silt, trace coarse sands Rimac: 3.250"-2.875", Pu = 69 lbs, shear failure	-30	2 10 9 10	1.3 S	
Lean Clay With Sand(CL) same as previous sample, glacial till with alternating sand layers/seams (590.59)				
Sandy Lean Clay With Gravel (CL) uniform olive gray, dry to moist, stiff, medium plasticity, few coarse to fine sands, trace little medium to fine subangular to subrounded gravels, unweathered, strong cementation, glacial till (588.59)	-35	2 6 7 9	4.0 P	
End of Boring	-40			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways
CH2M HILL

SOIL BORING LOG

Date 10/5/07

ROUTE I-74 DESCRIPTION New I-74 Bridge Over Mississippi River - Illinois Approach LOGGED BY F. Abreu

SECTION I-74 Bridge over Mississippi River LOCATION (N=562007.763, E=2459832.104), SEC. 32, TWP. 18N, RNG. 1W, 4th PM

COUNTY Rock Island DRILLING METHOD HSA, CME 55 HAMMER TYPE CME AUTOMATIC

STRUCT. NO. ______
Station ______

BORING NO. ILR0409
Station ______
Offset ______
Ground Surface Elev. 630.14 ft

Surface Water Elev. ______ ft
Stream Bed Elev. ______ ft

Groundwater Elev.:
First Encounter ______ ft
Upon Completion ______ ft
After ______ Hrs. ______ ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Grass Matter followed by silty clay with sand and topsoil	629.14				
Sandy Lean Clay(CL) olive gray to brown, dry, stiff, crumbly, few coarse to fine sands, trace fine gravels, subangular to subrounded, slightly oxidized, possible native soil			4 / 4 / 5 / 7	3.75-4.5 P	
olive gray to brown, dry, stiff, crumbly, few coarse to fine sands, trace fine gravels, subangular to subrounded, slightly oxidized, possible native soil		-5	3 / 6 / 7 / 9	4.5 P	
light olive gray clayey sand seams of medium to fine sands, followed by mottled dark gray with olive gray sand lean clay, occasional wood matter, possibc transition zone, native soil, slightly oxidized at bottom			5 / 6 / 7 / 9	3.75-4.5 P	
olive gray mottled with light gray and brown, dry, stiff, strong cementation, oxidized, trace medium to fine subangular to subrounded gravels, possible glacial till		-10	3 / 5 / 6 / 9	2.1 B	
uniform medium brown, dry, stiff, slightly oxidized at top to unweathered at bottom, strong cementation, little trace of fine subangular to subrounded gravels Rimac: Pu = 110 lbs	617.14				
Sandy Lean Clay With Gravel (CL) medium brown with gray, dry to moist, stiff, strong cementation, slightly oxidized at top scattered sand lenses Rimac: Pu = 91 lbs		-15	3 / 5 / 6 / 10	1.7 B	
	612.14				
Lean Clay With Sand(CL)		-20	2 / 6 / 7 / 8	1.9 B	

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Lean Clay With Sand(CL) uniform olive gray, dry to moist, stiff, little to fine coarse to fine sands, dark orange brown sand seam at center of sample that has oxidized heavily, remainder of sample is unweathered possible glacial till with scattered sand seam and sand pockets Rimac: Pu = 100 lbs *(continued)*	607.14				
Sandy Lean Clay(CL) uniform gray, stiff, dry to moist, few coarse to fine sands, strong cementation, possible unweathered glacial till Rimac: Pu = 110 lbs		-25	2 / 4 / 6 / 8	2.1 B	
same as above, uniform olive gray, stiff, unweathered till		-30	3 / 4 / 7 / 9	3.5 P	
same as above, uniform olive gray, unweathered glacial till Rimac: Pu = 110 lbs	595.14	-35	3 / 5 / 8 / 10	2.1 B	
End of Boring		-40			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways
CH2M HILL

SOIL BORING LOG

Date 11/18/05

ROUTE I-74 DESCRIPTION New I-74 Bridge Over Mississippi River - Illinois Approach LOGGED BY L. Hunt

SECTION I-74 Bridge over Mississippi River LOCATION (N=562103.589, E=2459813.573), SEC. 32, TWP. 18N, RNG. 1W, 4th PM

COUNTY Rock Island DRILLING METHOD HSA, CME 55 HAMMER TYPE CME AUTOMATIC

STRUCT. NO. ______
Station ______

BORING NO. RW1102
Station ______
Offset ______
Ground Surface Elev. 624.39 ft

Surface Water Elev. ______ ft
Stream Bed Elev. ______ ft

Groundwater Elev.:
First Encounter ______ ft
Upon Completion ______ ft
After ______ Hrs. ______ ft

Description	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)
Lean Clay (CL) Clay, trace gravel and sand, brown, moist, medium stiff, homogenous. Possibly till used as fill		4 4 3 3	1.6 P
Clay, trace gravel and sand, gray brown, moist, medium stiff, homogenous		11 3 4 5	0.8 P
Clay, trace gravel and sand, gray brown, moist, stiff, homogenous	-5	4 4 6 6	2.2 P
		4 4 6 7	2.4 P
	-10	3 4 5 7	3.5 P
		3 4 6 7	2.8 P
		4 6 9 9	3.2 P
	-15	3 5 7 9	3.1 P
	-20		

Description	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)
Lean Clay (CL) Clay, trace gravel and sand, brown, moist, medium stiff, homogenous. Possibly till used as fill *(continued)*		3 5 9 10	3.5 P
No sample Must have hit large cobble	-25	9 7 9 12	
594.39 **Sandy Lean Clay Trace Gravel (CL)** Clay, trace gravel and sand, gray brown, moist, stiff, homogenous, poss. till	-30	3 5 8 10	2.5 P
Large cobble stuck in the end of split spoon	-35	2 5 8 9	3.3 P
	-40		

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways
CH2M HILL

SOIL BORING LOG

Date 11/18/05

ROUTE I-74 DESCRIPTION New I-74 Bridge Over Mississippi River - Illinois Approach LOGGED BY L. Hunt

SECTION I-74 Bridge over Mississippi River LOCATION (N=562103.589, E=2459813.573), SEC. 32, TWP. 18N, RNG. 1W, 4th PM

COUNTY Rock Island DRILLING METHOD HSA, CME 55 HAMMER TYPE CME AUTOMATIC

STRUCT. NO. ______
Station ______

BORING NO. RW1102
Station ______
Offset ______
Ground Surface Elev. 624.39 ft

Surface Water Elev. ______ ft
Stream Bed Elev. ______ ft

Groundwater Elev.:
First Encounter ______ ft
Upon Completion ______ ft
After ___ Hrs. ______ ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Sandy Lean Clay Trace Gravel (CL) Clay, trace gravel and sand, gray brown, moist, stiff, homogenous, poss. till *(continued)* No cobbles			5		
			8	3.2	
			12	P	
			13		
	579.39	-45			
Silty Clay Trace Grave(CL-ML) Silty Clay, little sand, trace gravel, gray brown, dry to moist, very stiff, homogenous			5		
			8	4.5	
			11	P	
			13		
	576.39				
Sandy Lean Clay Trace Gravel (CL) Clay, trace sand and gravel, gray brown, dry to moist, very stiff, homogenous			5		
			8	4.2	
			11	P	
	574.39	-50	15		
End of Boring					
		-55			
		-60			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways
CH2M HILL

SOIL BORING LOG

Date 11/18/05

ROUTE I-74 DESCRIPTION New I-74 Bridge Over Mississippi River - Illinois Approach LOGGED BY L. Hunt

SECTION I-74 Bridge over Mississippi River LOCATION (N=562394.911, E=2459803.548), SEC. 32, TWP. 18N, RNG. 1W, 4th PM

COUNTY Rock Island DRILLING METHOD HSA, CME 55 HAMMER TYPE CME AUTOMATIC

STRUCT. NO. ______
Station ______

BORING NO. RW1105
Station ______
Offset ______
Ground Surface Elev. 611.15 ft

Surface Water Elev. ______ ft
Stream Bed Elev. ______ ft

Groundwater Elev.:
First Encounter ______ ft
Upon Completion ______ ft
After ______ Hrs. ______ ft

Description	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Clay (CL) Clay, trace sand and gravel, red brown to gray brown, moist, very stiff, stratified (red-12"; gray-8")		3 4 5 5	3.5 P	
Clay, some silt, trace gravel and sand, gray brown, moist, medium stiff, homogenous Till		3 2 4 5	1.8 P	
	-5		2.1 P	15.0
Clay, some silt, trace sand and gravel, gray brown, moist, stiff, homogenous		2 5 7 8	2.1 P	
Clay, some silt, trace sand and gravel, gray brown, moist, stiff, homogenous	-10	4 5 8 9	2.0 P	
Clay, some silt, trace sand and gravel, gray brown, moist, stiff, homogenous		4 5 6 8	2.3 P	
Clay, some silt, trace sand and gravel, gray brown, moist, stiff, homogenous		4 6 9 9	2.5 P	
Clay, some silt, trace sand and gravel, gray brown, moist, medium stiff, homogenous	-15	4 5 8 9	1.8 P	
	-20			

Description	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Clay (CL) Clay, trace sand and gravel, red brown to gray brown, moist, very stiff, stratified (red-12"; gray-8") *(continued)*		4 6 7 9	2.0 P	
Clay, some silt, trace sand and gravel, gray brown, moist, medium stiff, homogenous				
Clay, some silt, trace sand and gravel, gray brown, moist, stiff, homogenous	-25	4 6 9 12	2.5 P	
Clay, some silt, trace sand and gravel, gray brown, moist, stiff, homogenous	-30	4 7 9 11	3.3 P	
Clay, some silt, trace sand and gravel, gray brown, moist, stiff, homogenous	-35	4 7 9 12	2.4 P	
	-40			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways
CH2M HILL

SOIL BORING LOG

Date 11/18/05

ROUTE I-74 DESCRIPTION New I-74 Bridge Over Mississippi River - Illinois Approach LOGGED BY L. Hunt

SECTION I-74 Bridge over Mississippi River LOCATION (N=562394.911, E=2459803.548), SEC. 32, TWP. 18N, RNG. 1W, 4th PM

COUNTY Rock Island DRILLING METHOD HSA, CME 55 HAMMER TYPE CME AUTOMATIC

STRUCT. NO. ______
Station ______

BORING NO. RW1105
Station ______
Offset ______
Ground Surface Elev. 611.15 ft

Surface Water Elev. ______ ft
Stream Bed Elev. ______ ft

Groundwater Elev.:
First Encounter ______ ft
Upon Completion ______ ft
After ___ Hrs. ______ ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Clay (CL) Clay, trace sand and gravel, red brown to gray brown, moist, very stiff, stratified (red-12"; gray-8") *(continued)*			7		
			14	4.5	
			24	P	
			23		
Clay, some silt, trace sand and gravel, gray brown, moist, stiff, homogenous	566.15	-45			
Sand (SP) Sand, trace clay gray brown, wet, loose to medium dense, homogenous			3		
			11		
			7		
	564.15		12		
Clayey Sand To Shale (SC) Clayey Sand to Shale, gray brown, wet to moist, medium dense, stratified (SC-4"; Shale-4")			23		
			50/3		
	561.15	-50			
End of Boring		-55			
		-60			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways
CH2M HILL

SOIL BORING LOG

Date 11/19/05

ROUTE I-74 DESCRIPTION New I-74 Bridge Over Mississippi River - Illinois Approach LOGGED BY L. Hunt

SECTION I-74 Bridge over Mississippi River LOCATION (N=562704.911, E=2459806.583), SEC. 32, TWP. 18N, RNG. 1W, 4th PM

COUNTY Rock Island DRILLING METHOD HSA, CME 55 HAMMER TYPE CME AUTOMATIC

STRUCT. NO. ____
Station ____

BORING NO. RW1108
Station ____
Offset ____
Ground Surface Elev. 593.85 ft

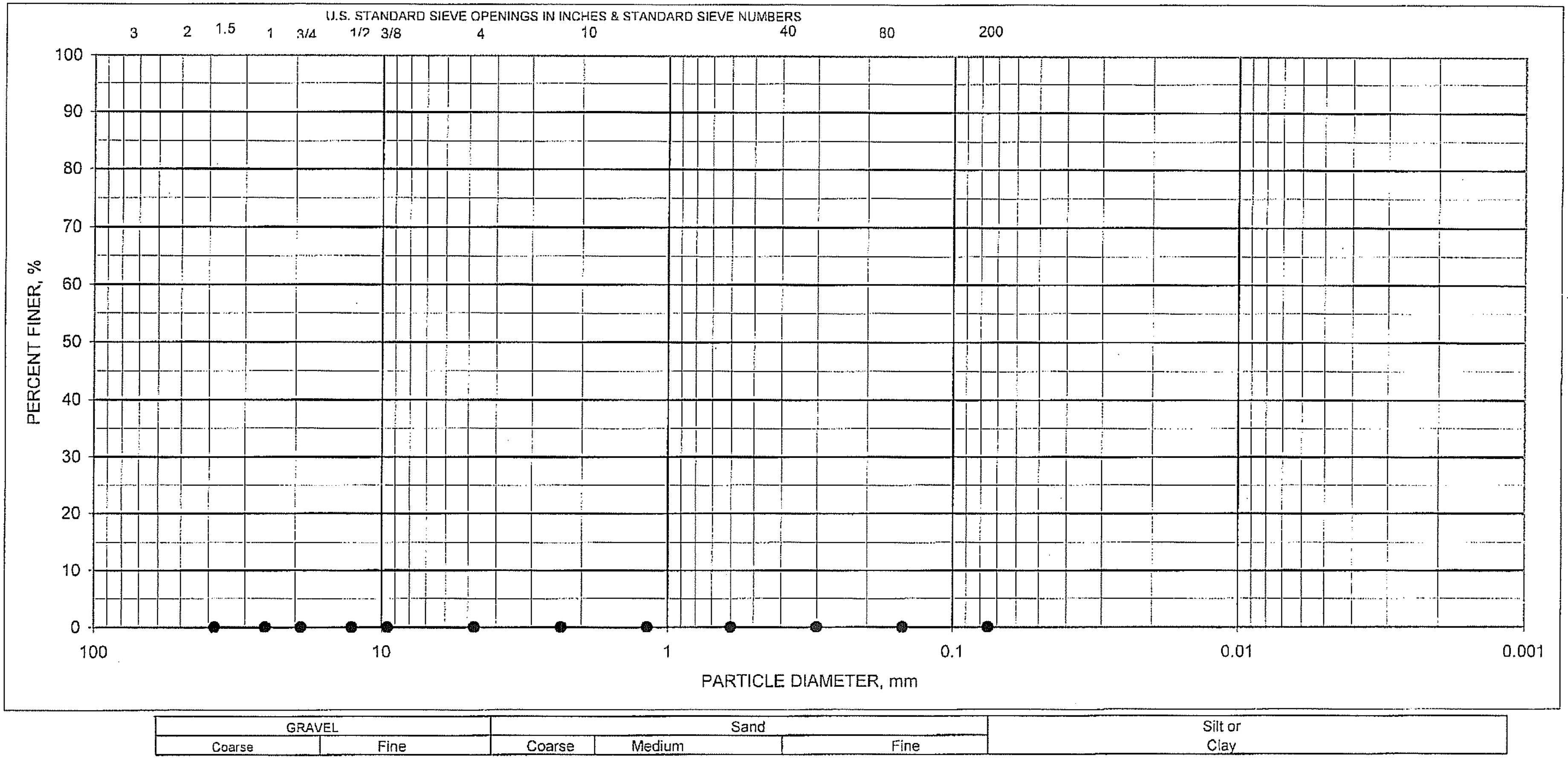
Surface Water Elev. ____ ft
Stream Bed Elev. ____ ft

Groundwater Elev.:
First Encounter ____ ft
Upon Completion ____ ft
After ____ Hrs. ____ ft

Description	Bottom Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Clay (CL) Clay, trace gravel, little sand, dark brown to red brown, mottled gray brown, dry to moist, stiff, stratified (dark brown - top 5") Clay to Silty Clay, gray brown, dry to moist, stiff, stratified (Silty Clay - 8")			5 6 6 4	3.2 P	
	589.85		3 5 7 9	4.5 P	
Clayey Silt(MH) Clayey Silt, light gray brown, mottled orange brown, loose to medium stiff, moist, homogenous		-5	3 7 6 8	1.0 P	
Clayey Silt to Clayey Fine Sand, gray brown mottled orange brown, moist, loose, homogenous, grades down to sand	585.85		3 7 10 10	4.0 P	18.0
Clayey Fine Sand To Sand(SC) Clayey Fine Sand to Sand, till, trace gravel and sand, gray brown, very stiff, moist, stratified (ML-4", SP-5", till-15")		-10	7 9 10 13		
Clay (8") to Clayey Fine Sand and Silt (ML-16"), gray brown, moist, stiff to medium stiff to medium dense, stratified	581.85		4 8 10 12	3.0 P	
Sand To Clay(SP) Sand (10") to Clay (14"), trace gravel, gray brown, wet to moist, very loose to hard, stratified	579.85		4 5 7 9	3.0 P	
Clay (CL) Clay, trace gravel, gray brown, moist, hard, homogenous		-15	3 6 9 11	3.3 P	
		-20			
Clay (CL) Clay, trace gravel, gray brown, moist, hard, homogenous *(continued)* Clay, trace gravel, gray brown, moist, hard, homogenous			5 7 9 10	3.3 P	
Silty Clay, trace gravel and sand, gray brown, moist, very stiff, homogenous	563.85	-25	4 5 9 11	2.5 P	
Sand To Gravel(SP) Sand to Gravel, gray brown, wet, loose, homogenous, fine to coarse grained, well rounded, poorly sorted	558.85	-30	22 50/4		
Silt (ML) Silt, trace gravel, gray brown, wet, medium dense, homogenous, well rounded, poorly sorted	555.85	-35	50/5.5		
End of Boring		-40			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Appendix D
Laboratory Data



GRAIN SIZE DISTRIBUTION CURVE

BORING NO.	SAMPLE NO.	DEPTH, feet	SOIL DESCRIPTION	UNIFIED SYMBOL	NAT. WC, %	ATTERBERG LIMITS LL	PL	PI
ILR0402	3	6	Clay	CL	23.5	40	19	21

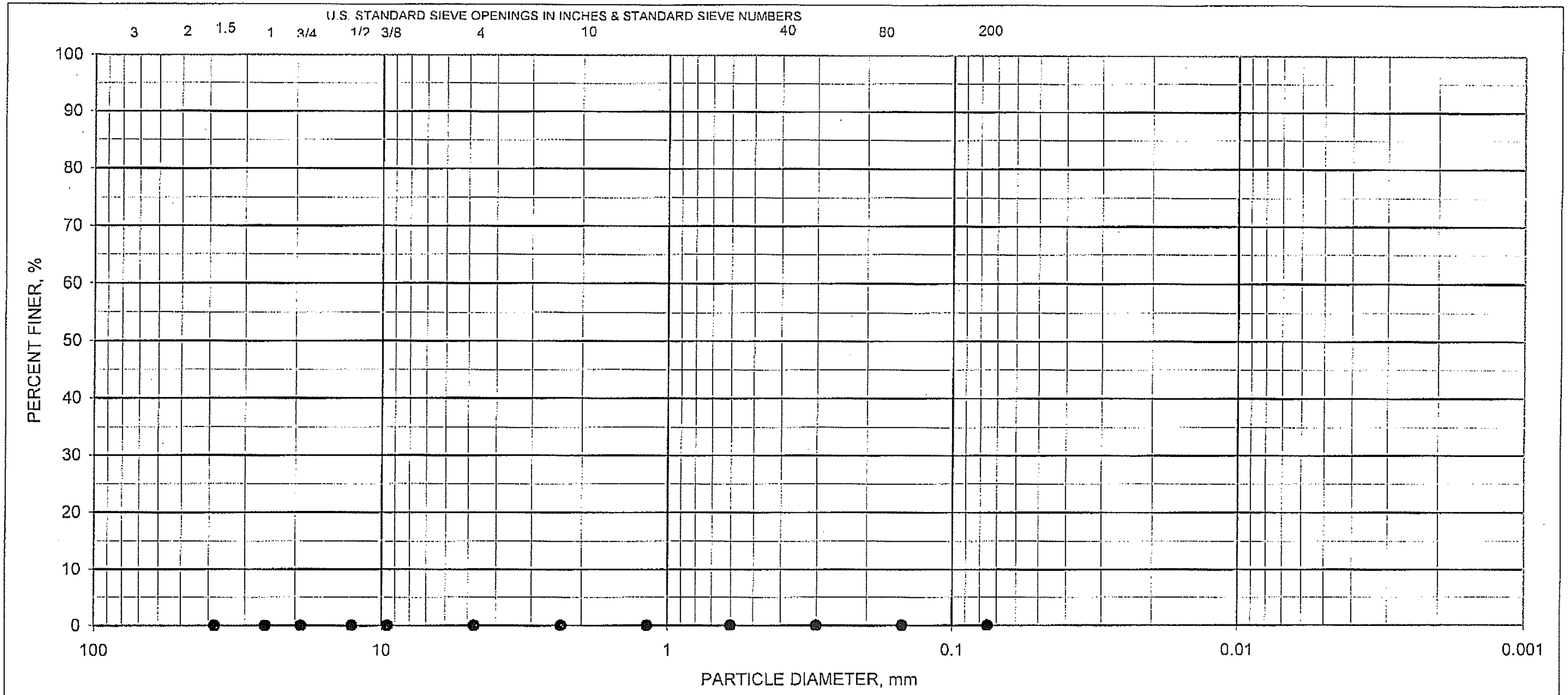
PROJECT I-74 Corridor

Moline, IL

PROJECT NO. 07045052 DATE 2/13/2008

Terracon

N:\Projects\2004\07045052\lab data\Grain Size Distribution\[ILR0402 S-3.xls]ACT DATA



GRAVEL		Sand			Silt or Clay
Coarse	Fine	Coarse	Medium	Fine	

GRAIN SIZE DISTRIBUTION CURVE

BORING NO.	SAMPLE NO.	DEPTH, feet	SOIL DESCRIPTION	UNIFIED SYMBOL	NAT. WC, %	ATTERBERG LIMITS LL	PL	PI
ILR0402	5	10		CL	19.3	37	17	20

PROJECT I-74 Corridor

Moline, IL PROJECT NO. 07045052 DATE 2/13/2008

Terracon

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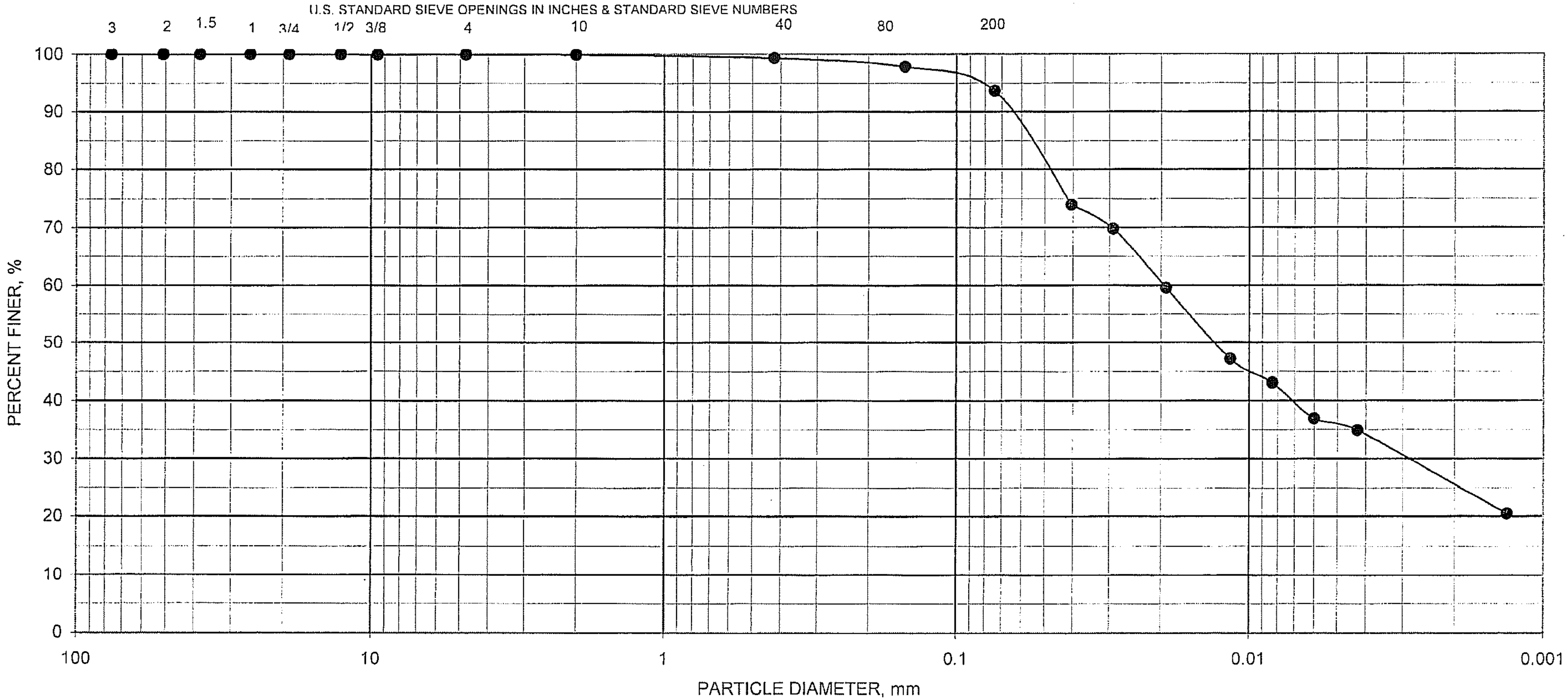

GRAVEL		Sand			Silt or Clay
Coarse	Fine	Coarse	Medium	Fine	

GRAIN SIZE DISTRIBUTION CURVE

BORING NO.	SAMPLE NO.	DEPTH, feet	ASTM DESCRIPTION	UNIFIED SYMBOL	NAT. WC, %	ATTERBERG LIMITS LL	PL	PI
ILR0402	6	10-14			18.9			

PROJECT I-74 Corridor

Moline, IL

JOB NO. 07045052 DATE 2/14/2008

Terracon

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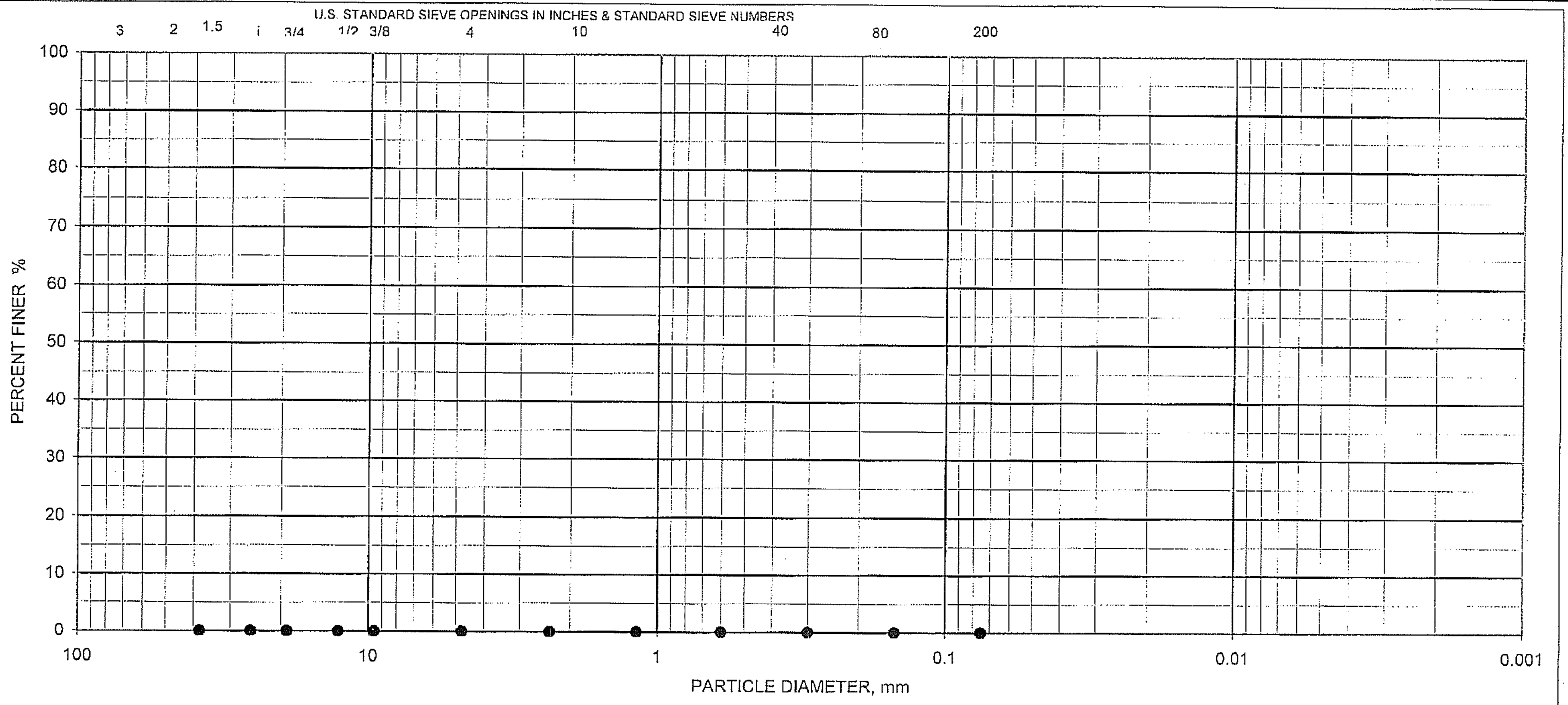

GRAVEL		Sand			Silt or Clay
Coarse	Fine	Coarse	Medium	Fine	

GRAIN SIZE DISTRIBUTION CURVE

BORING NO.	SAMPLE NO.	DEPTH, feet	SOIL DESCRIPTION	UNIFIED SYMBOL	NAT. WC, %	ATTERBERG LIMITS LL	PL	PI
ILR0402	7	14	Clay	CL		32	17	15

PROJECT I-74 Corridor

Moline, IL

PROJECT NO. 07045052 DATE 2/21/2008

Terracon

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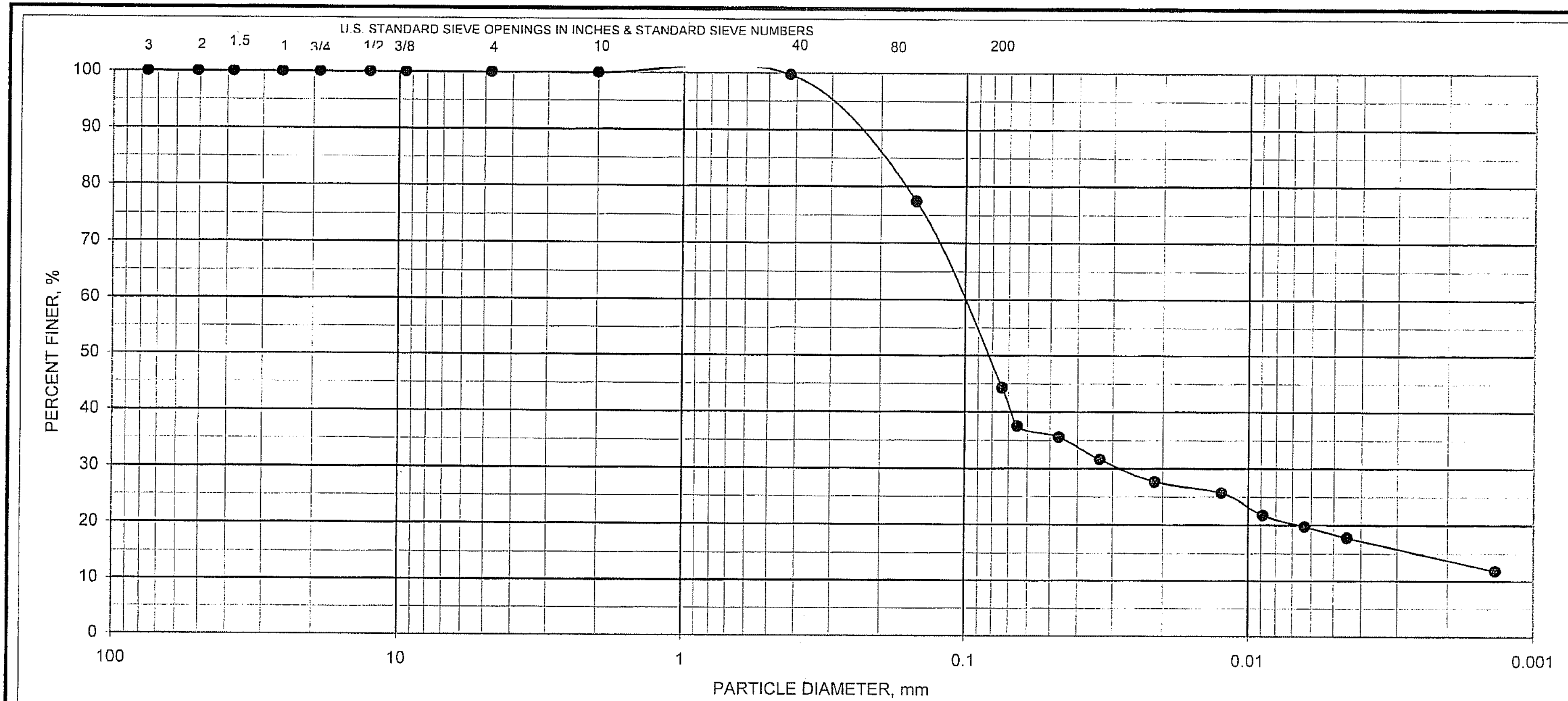

GRAVEL		Sand			Silt or Clay
Coarse	Fine	Coarse	Medium	Fine	

GRAIN SIZE DISTRIBUTION CURVE

BORING NO.	SAMPLE NO.	DEPTH, feet	ASTM DESCRIPTION	UNIFIED SYMBOL	NAT. WC, %	ATTERBERG LIMITS LL	PL	PI
ILR0402	9	20			18.4			

PROJECT I-74 Corridor

Moline, IL

JOB NO. 07045052 DATE 2/14/2008

Terracon

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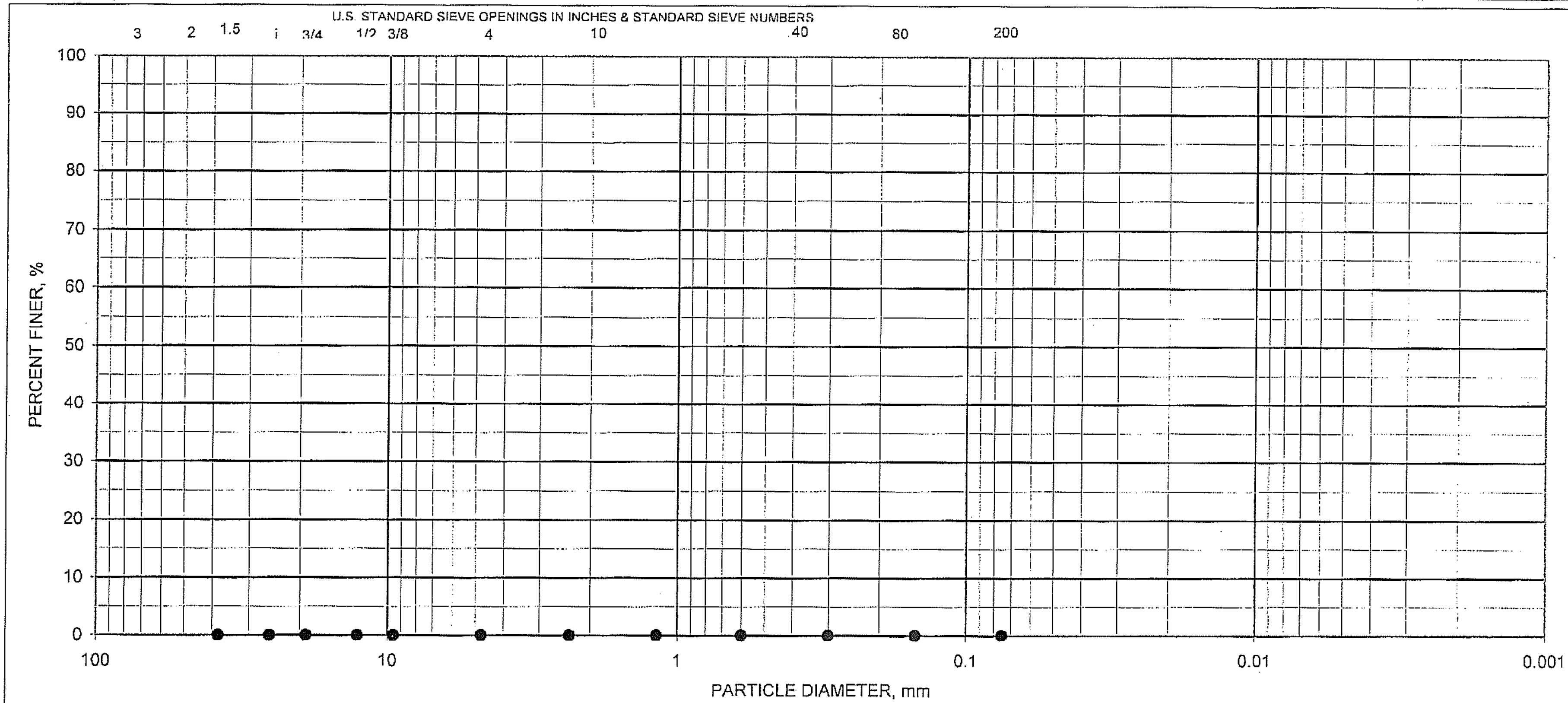

GRAVEL		Sand			Silt or Clay
Coarse	Fine	Coarse	Medium	Fine	

GRAIN SIZE DISTRIBUTION CURVE

BORING NO.	SAMPLE NO.	DEPTH, feet	SOIL DESCRIPTION	UNIFIED SYMBOL	NAT. WC, %	ATTERBERG LIMITS LL	PL	PI
ILR0407	2	3	Silt	CL		34	18	16

PROJECT I-74 Corridor

Moline, IL

PROJECT NO. 07045052

DATE 2/13/2008

Terracon

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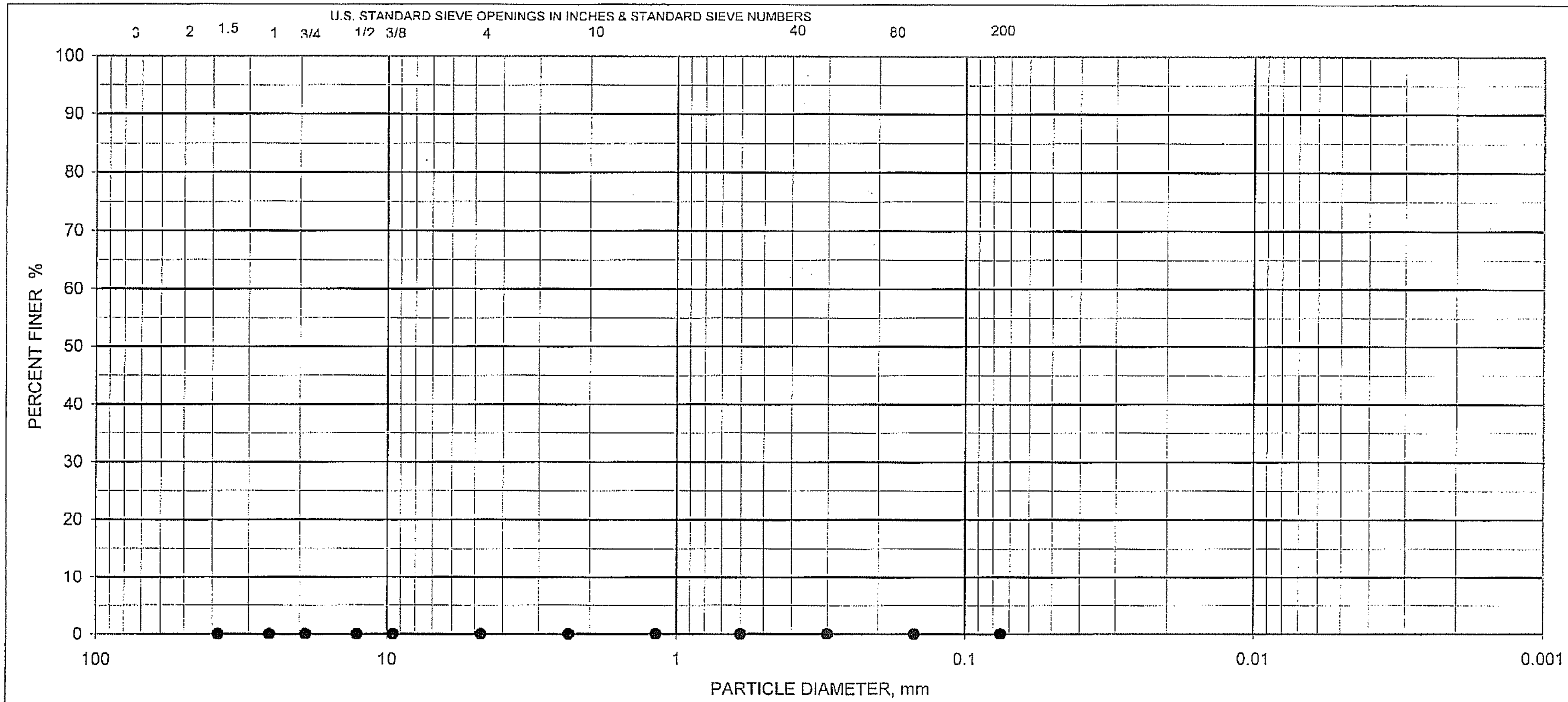

GRAVEL		Sand			Silt or Clay
Coarse	Fine	Coarse	Medium	Fine	

GRAIN SIZE DISTRIBUTION CURVE

BORING NO.	SAMPLE NO.	DEPTH, feet	SOIL DESCRIPTION	UNIFIED SYMBOL	NAT. WC, %	ATTERBERG LIMITS LL	PL	PI
ILR0403	11	35	Clay	CL		30	15	15

PROJECT I-74 Corridor

Moline, IL PROJECT NO. 07045052 DATE 2/13/2008

Terracon

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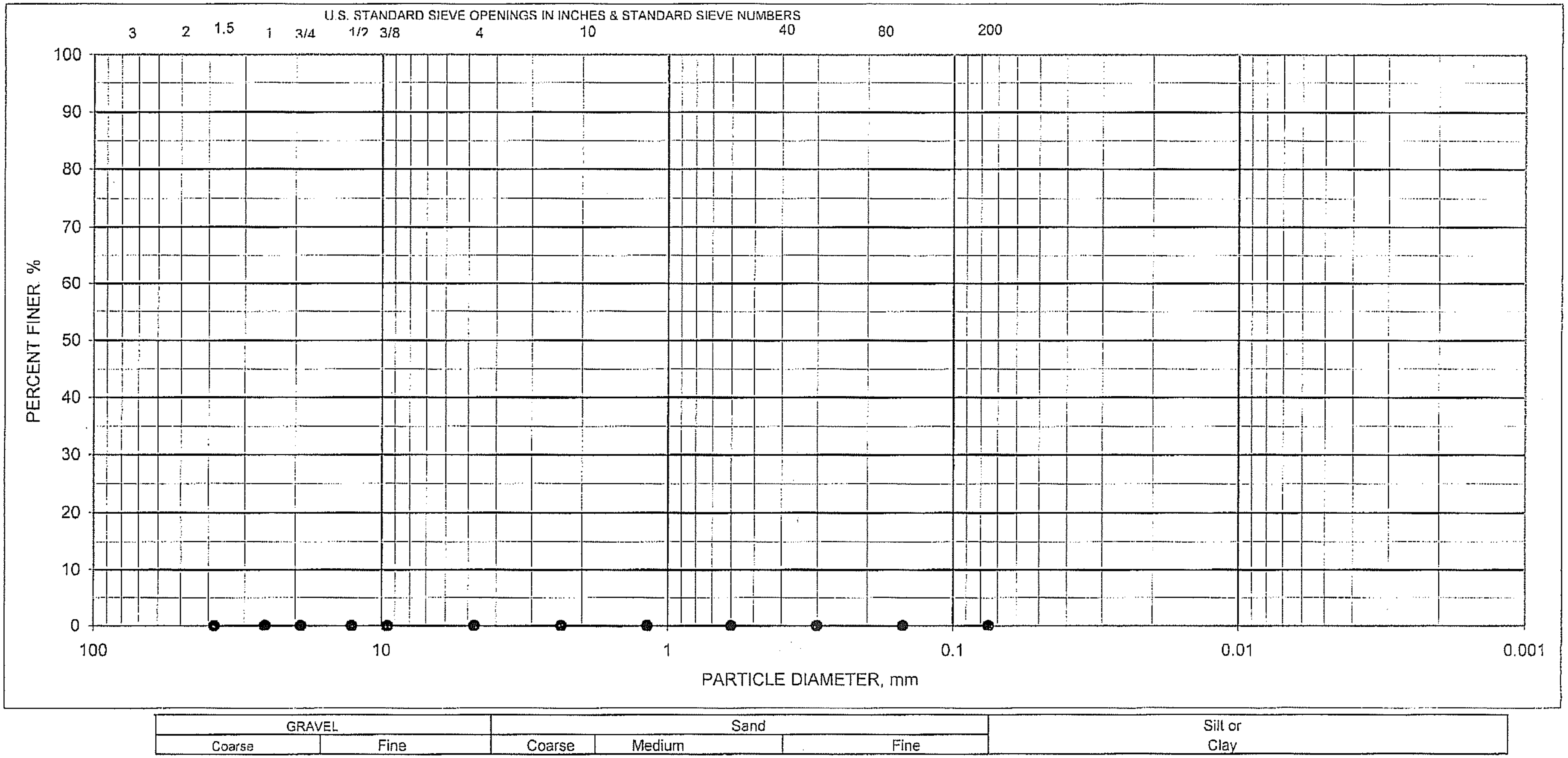

GRAIN SIZE DISTRIBUTION CURVE

BORING NO.	SAMPLE NO.	DEPTH, feet	SOIL DESCRIPTION	UNIFIED SYMBOL	NAT. WC, %	ATTERBERG LIMITS LL	PL	PI
ILR0403	10	25	Clay	CL		25	12	13

PROJECT I-74 Corridor

Moline, IL

PROJECT NO. 07045052 DATE 2/21/2008

Terracon

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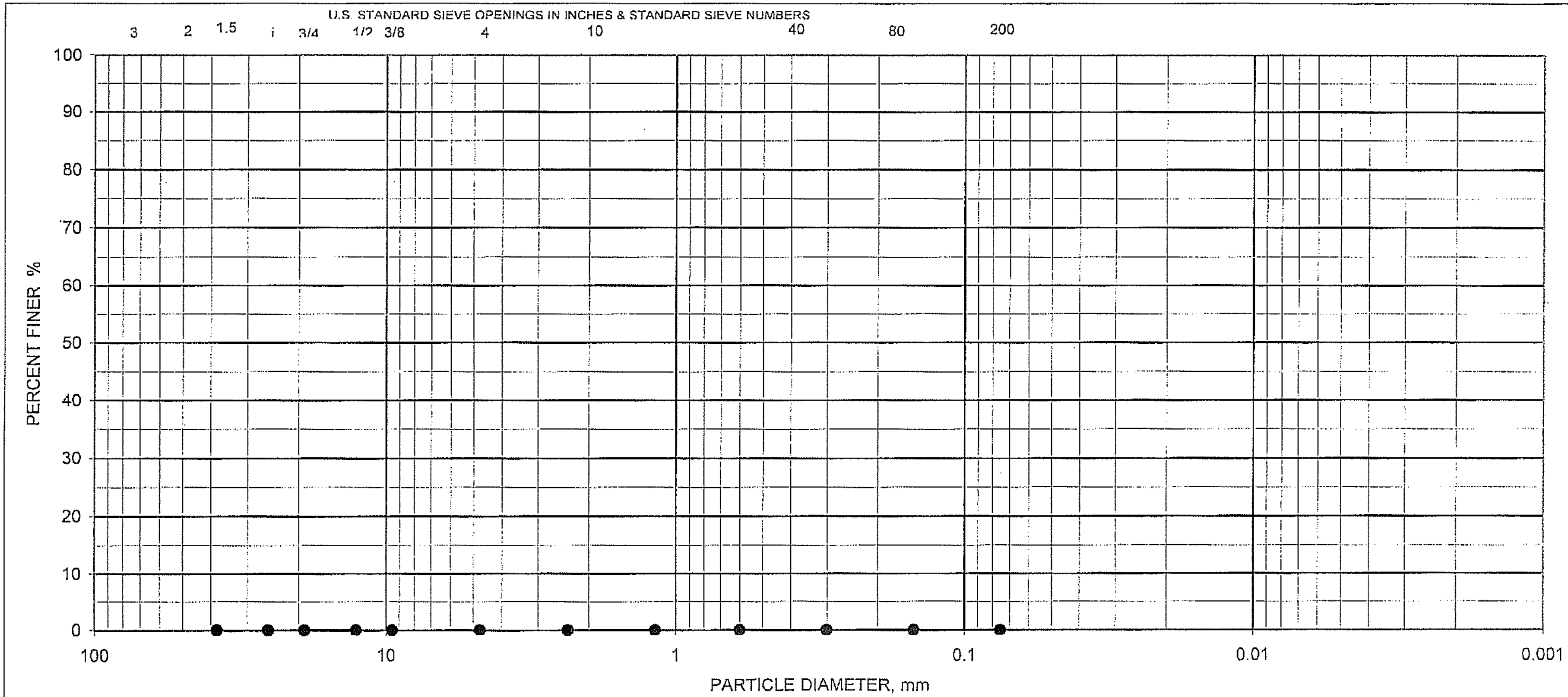


GRAVEL		Sand			Silt or Clay
Coarse	Fine	Coarse	Medium	Fine	

GRAIN SIZE DISTRIBUTION CURVE

BORING NO.	SAMPLE NO.	DEPTH, feet	SOIL DESCRIPTION	UNIFIED SYMBOL	NAT. WC, %	ATTERBERG LIMITS LL	PL	PI
ILR0404	2	3	Clay	CH		30	13	17

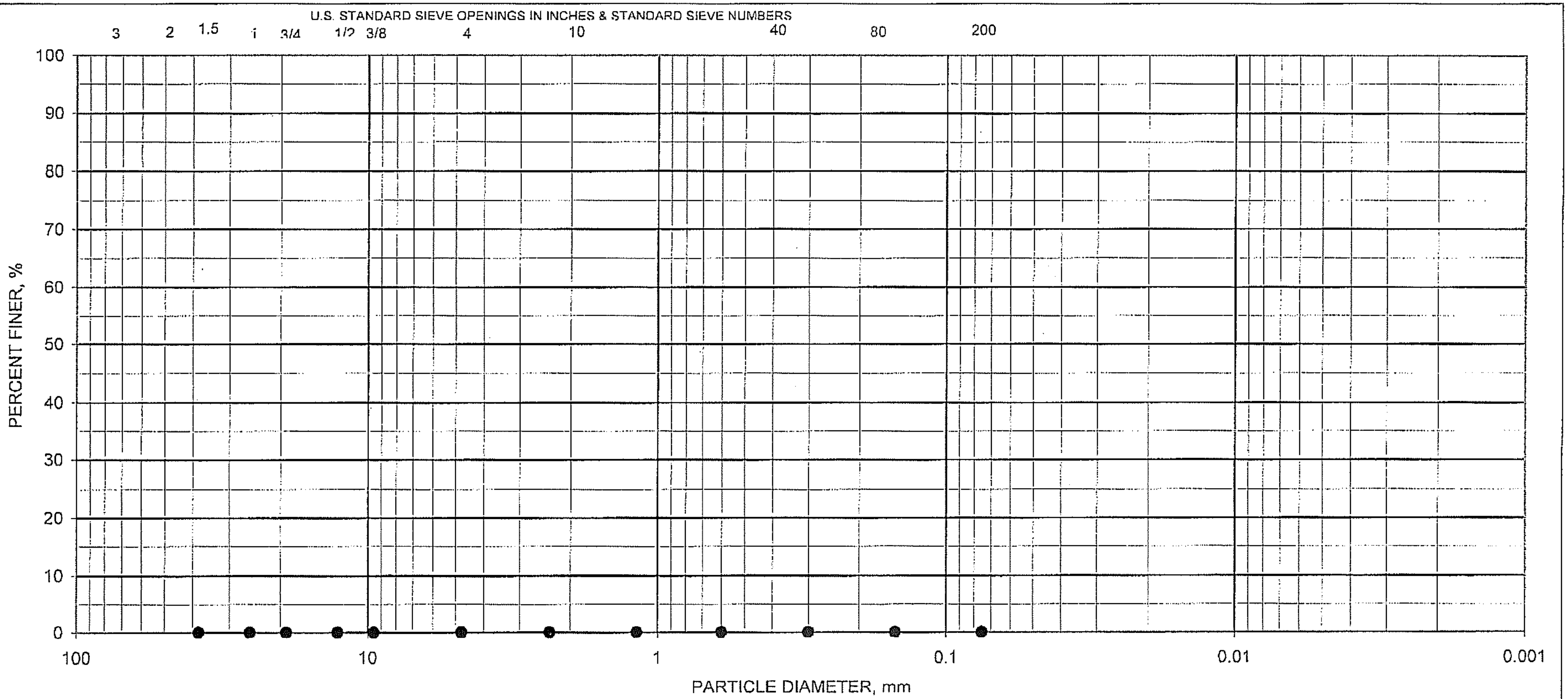
PROJECT I-74 Corridor

Moline, IL

PROJECT NO. 07045052 DATE 2/18/2008

Terracon

N:\Projects\2004\07045052\lab data\Grain Size Distribution\[ILR0404 S-2.xls]ACT DATA



GRAVEL		Sand			Silt or Clay
Coarse	Fine	Coarse	Medium	Fine	

GRAIN SIZE DISTRIBUTION CURVE

BORING NO.	SAMPLE NO.	DEPTH, feet	SOIL DESCRIPTION	UNIFIED SYMBOL	NAT. WC, %	ATTERBERG LIMITS LL	PL	PI
ILR0404	3	6	Clay	CL		39	16	23

PROJECT I-74 Corridor

Moline, IL

PROJECT NO. 07045052 DATE 2/13/2008

Terracon

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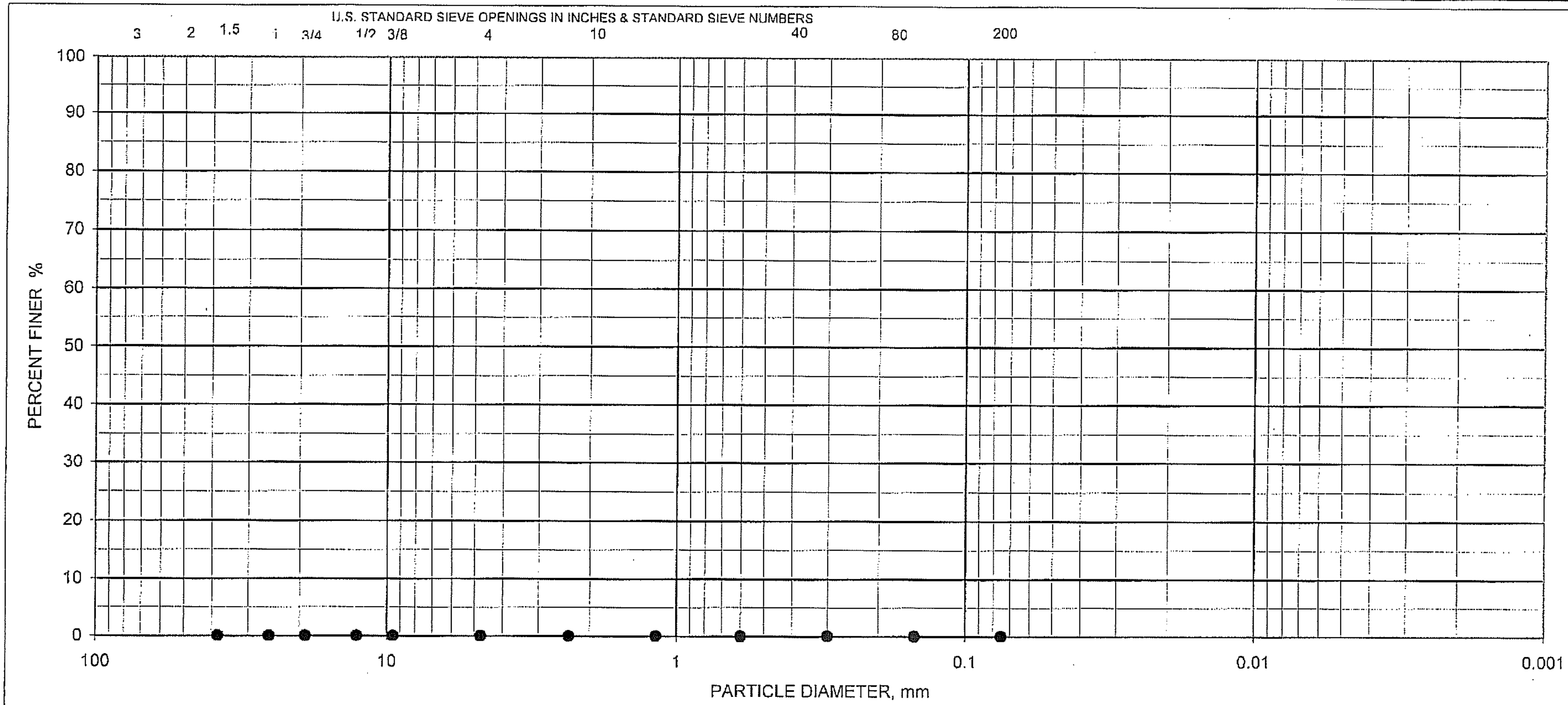

GRAVEL		Sand			Silt or Clay
Coarse	Fine	Coarse	Medium	Fine	

GRAIN SIZE DISTRIBUTION CURVE

BORING NO.	SAMPLE NO.	DEPTH, feet	SOIL DESCRIPTION	UNIFIED SYMBOL	NAT. WC, %	ATTERBERG LIMITS LL	PL	PI
ILR0409	8	28-38		CL	13.9	39	14	25

PROJECT I-74 Corridor

Moline, IL

PROJECT NO. 07045052 DATE 2/14/2008

Terracon

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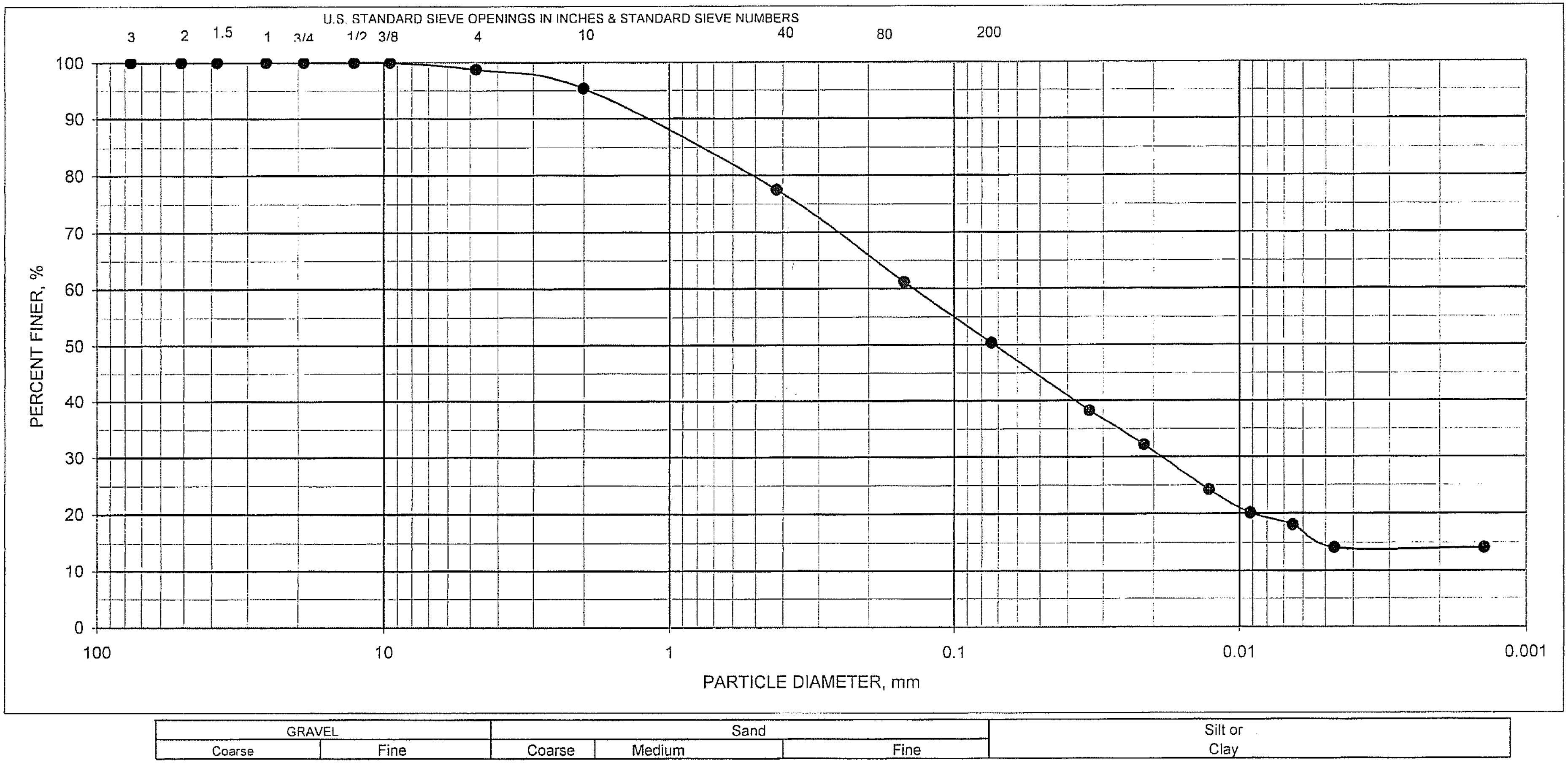


GRAIN SIZE DISTRIBUTION CURVE

BORING NO.	SAMPLE NO.	DEPTH, feet	ASTM DESCRIPTION	UNIFIED SYMBOL	NAT. WC, %	ATTERBERG LIMITS LL	PL	PI
ILR0404	7	25				19	12	7

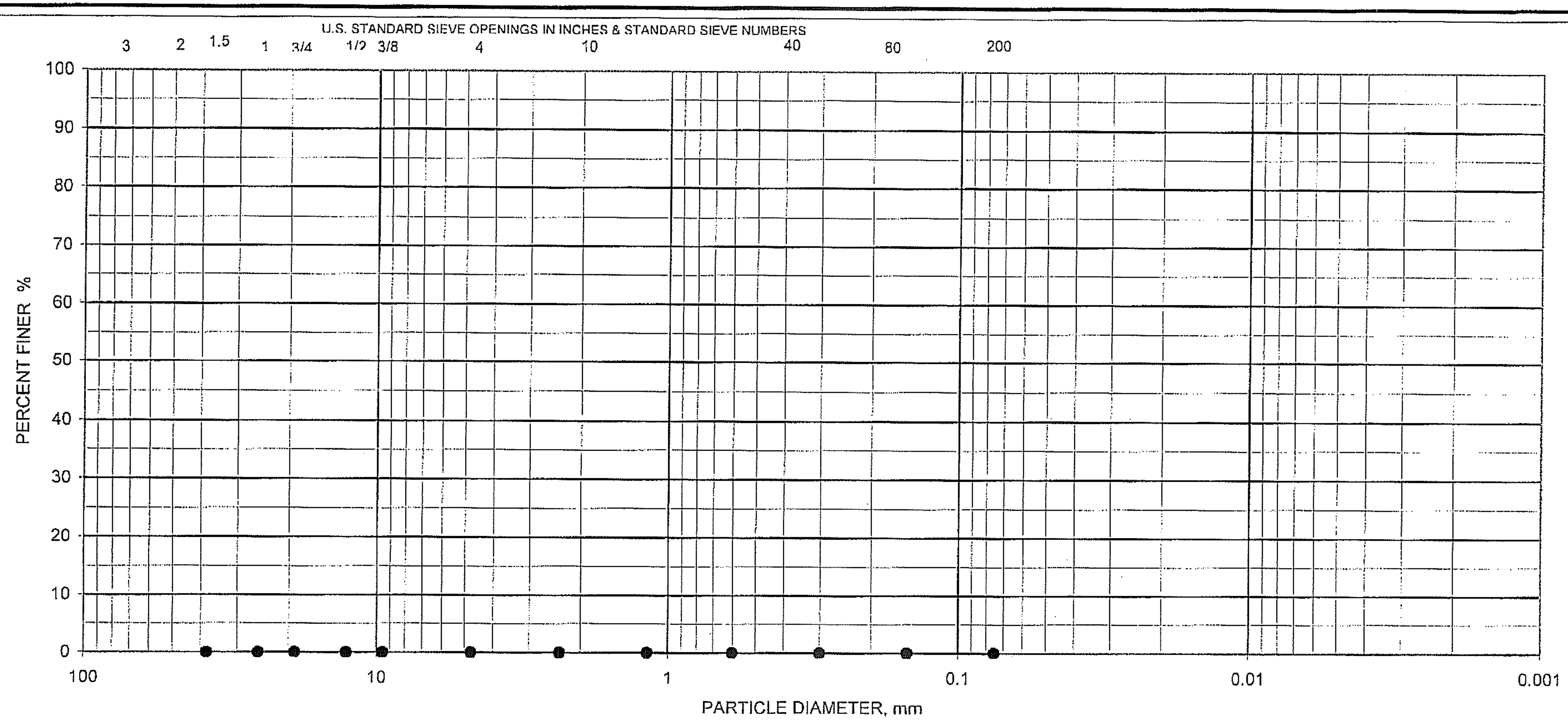
PROJECT I-74 Corridor

Moline, IL

JOB NO. 07045052 DATE 2/21/2008

Terracon

N:\Projects\2004\07045052\lab data\Hydrometer\[ILR0404 S-7.xls]ACT DATA



GRAVEL		Sand			Silt or Clay
Coarse	Fine	Coarse	Medium	Fine	

GRAIN SIZE DISTRIBUTION CURVE

BORING NO.	SAMPLE NO.	DEPTH, feet	SOIL DESCRIPTION	UNIFIED SYMBOL	NAT. WC, %	ATTERBERG LIMITS LL	PL	PI
ILR0407	4	8	Clay	CL		32	18	14

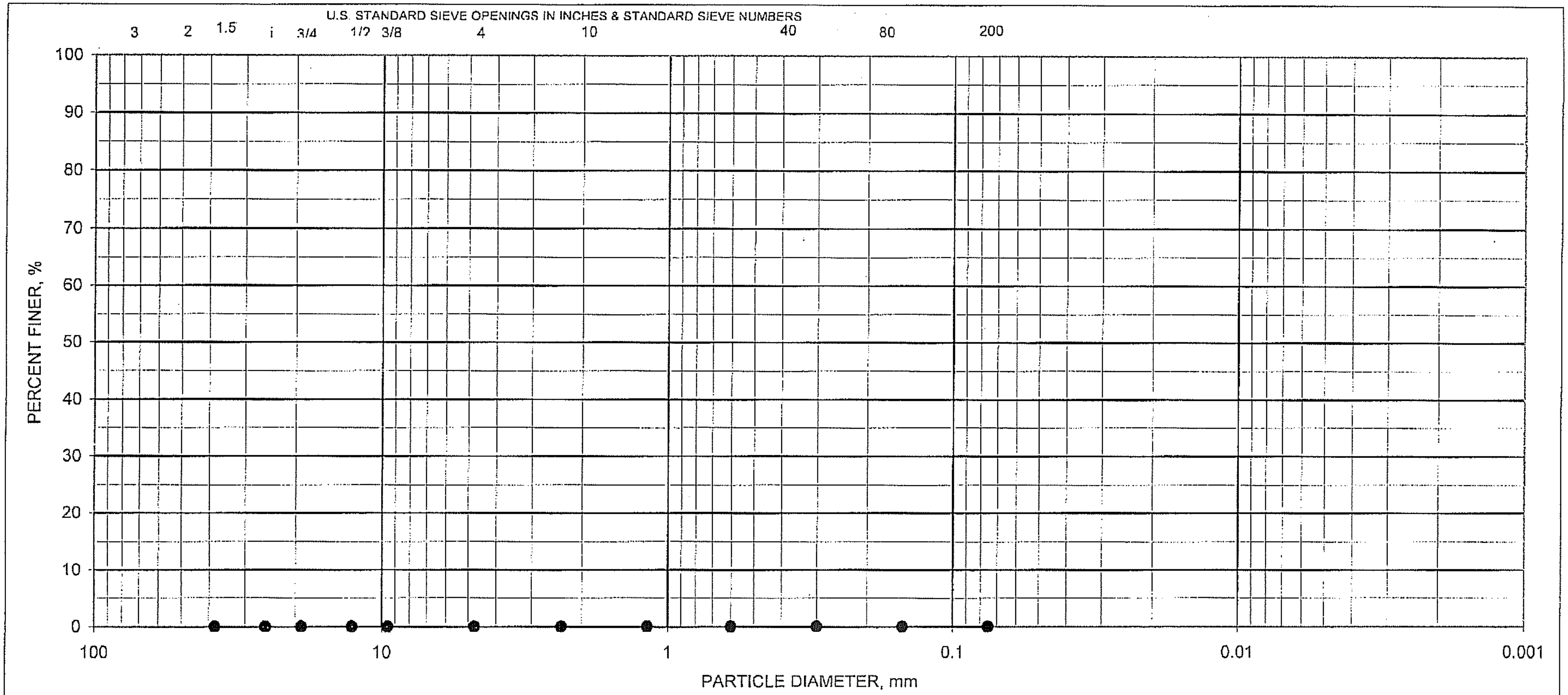
PROJECT I-74 Corridor

Moline, IL

PROJECT NO. 07045052 DATE 2/13/2008

Terracon

N:\Projects\2004\07045052\lab data\Grain Size Distribution\[ILR0407 S-4.xls]ACT DATA



GRAVEL		Sand			Silt or Clay
Coarse	Fine	Coarse	Medium	Fine	

GRAIN SIZE DISTRIBUTION CURVE

BORING NO.	SAMPLE NO.	DEPTH, feet	SOIL DESCRIPTION	UNIFIED SYMBOL	NAT. WC, %	ATTERBERG LIMITS LL	PL	PI
ILR0407	6	20	Clay	CL		33	15	18

PROJECT I-74 Corridor

Moline, IL PROJECT NO. 07045052 DATE 2/13/2008

Terracon

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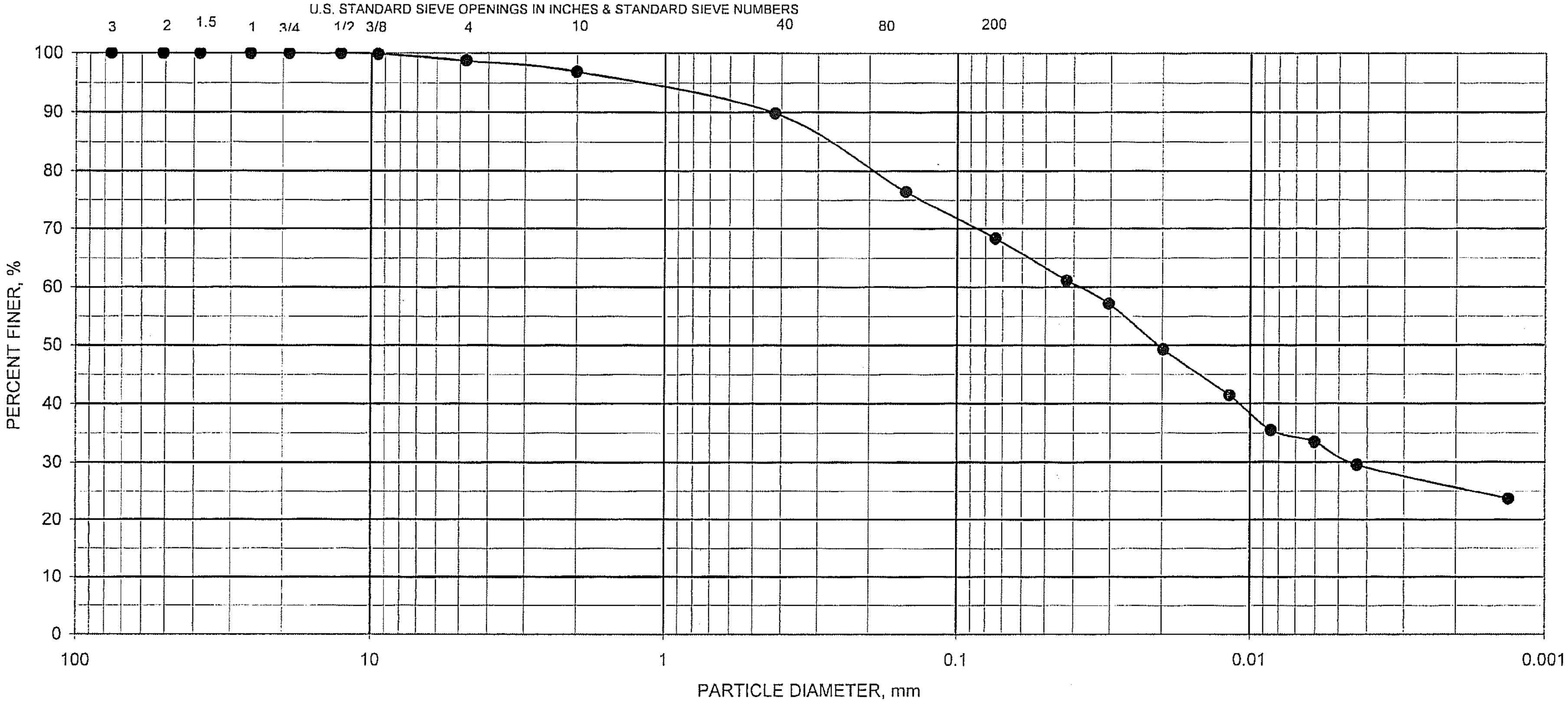

GRAVEL		Sand			Silt or Clay
Coarse	Fine	Coarse	Medium	Fine	

GRAIN SIZE DISTRIBUTION CURVE

BORING NO.	SAMPLE NO.	DEPTH, feet	ASTM DESCRIPTION	UNIFIED SYMBOL	NAT. WC, %	ATTERBERG LIMITS LL	PL	PI
ILR0409	4	8						

PROJECT I-74 Corridor

Moline, IL JOB NO. 07045052 DATE 2/21/2008

Terracon

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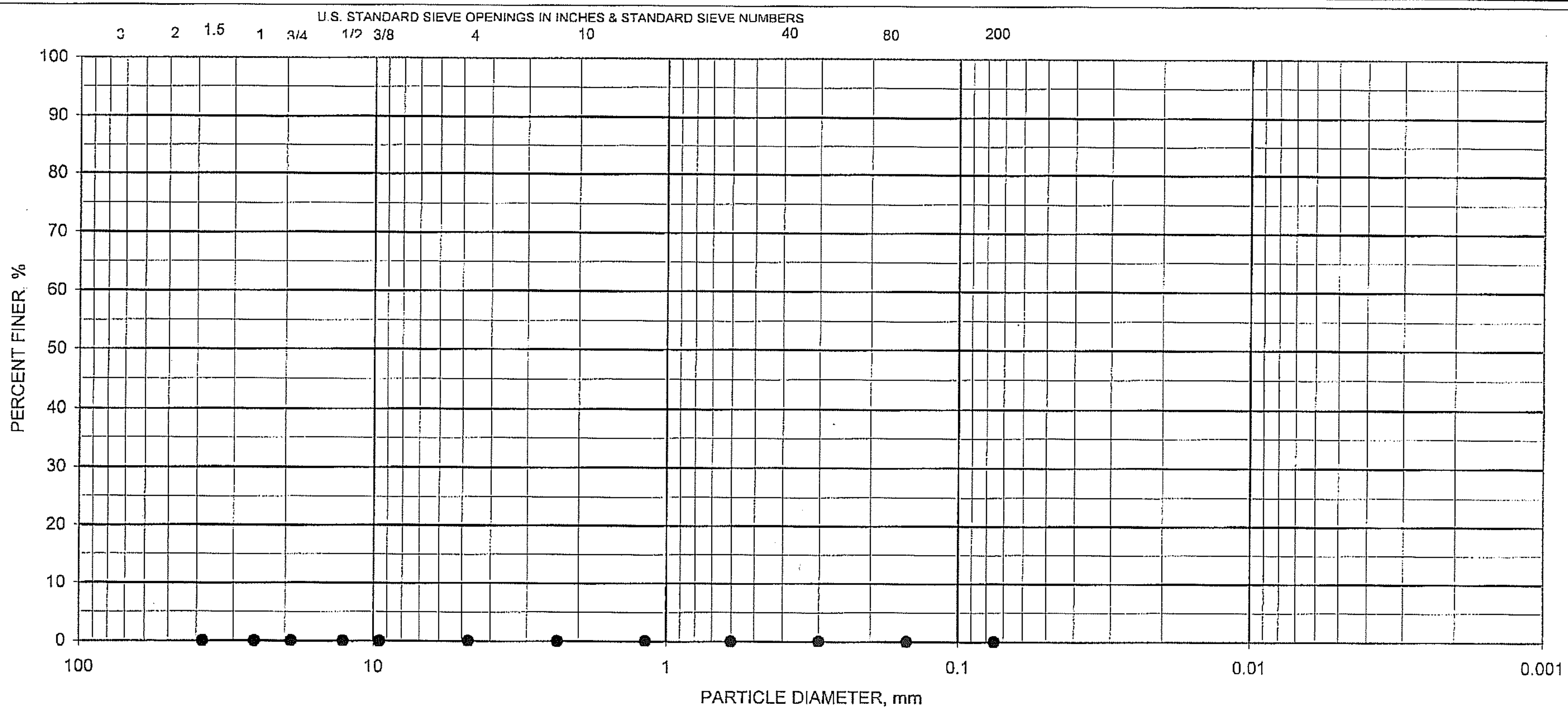

GRAVEL		Sand			Silt or Clay
Coarse	Fine	Coarse	Medium	Fine	

GRAIN SIZE DISTRIBUTION CURVE

BORING NO.	SAMPLE NO.	DEPTH, feet	SOIL DESCRIPTION	UNIFIED SYMBOL	NAT. WC, %	ATTERBERG LIMITS LL	PL	PI
ILR0409	6	23-25	Lean Clay with Sand	CL	16.2	30	13	17

PROJECT I-74 Corridor

Moline, IL

PROJECT NO. 07045052 DATE 2/13/2008

Terracon

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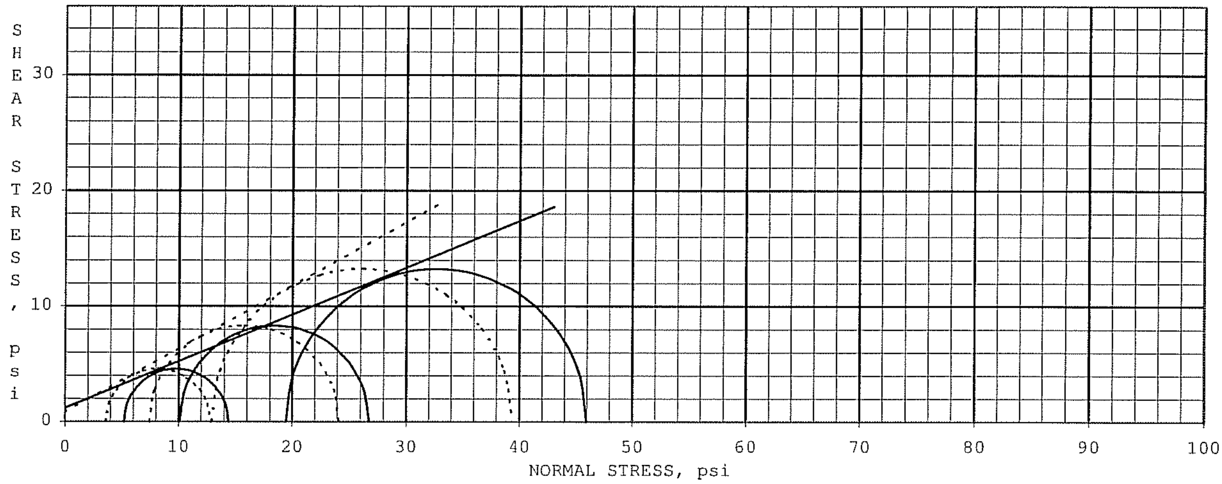
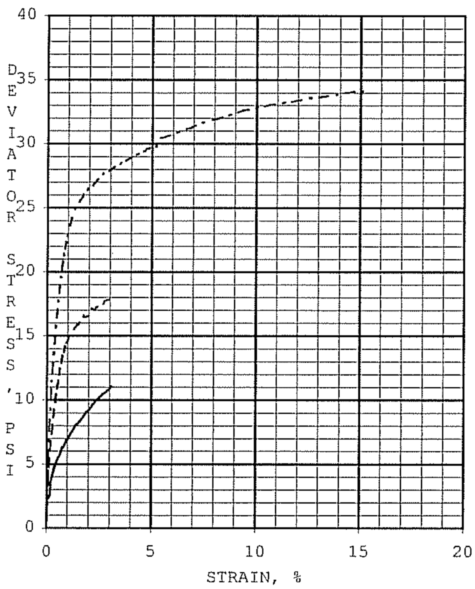


EFFECTIVE STRESS	ANGLE OF INTERNAL FRICTION, deg	28.9	COHESION, psi	0.8
TOTAL STRESS	ANGLE OF INTERNAL FRICTION, deg	22.0	COHESION, psi	1.2



SPECIMEN #:		A	B	C
INITIAL	WATER CONTENT, %	15.0	15.5	14.9
INITIAL	DRY DENSITY, pcf	117.8	118.9	120.1
INITIAL	SATURATION, %	94	100	100
INITIAL	VOID RATIO	0.43	0.42	0.40
BEFORE SHEAR	WATER CONTENT, %	15.5	14.9	14.2
BEFORE SHEAR	DRY DENSITY, pcf	118.9	120.1	121.7
BEFORE SHEAR	SATURATION (B PARAMETER)	1.00	1.00	1.00
BEFORE SHEAR	VOID RATIO	0.42	0.40	0.38
BEFORE SHEAR	FINAL BACK PRESSURE, psi	100.1	100.1	100.7
MINOR PRINCIPAL STRESS, psi		105.3	110.2	120.1
DEVIATOR STRESS @ 2% STRAIN, psi		9.2	16.7	26.5
TIME TO 2% STRAIN, min.		231	235	235
ULTIMATE DEVIATOR STRESS, psi		NA	NA	34.2
INITIAL DIAMETER, inch		2.739	2.764	2.784
INITIAL HEIGHT, inch		5.803	5.644	5.508
AREA AFTER CONSOLIDATION, inch2*		5.847	5.928	5.985

CONTROLLED - STRAIN TEST

t_{50} 32.1 min | Strain Rate, %/hr 0.52

DESCRIPTION OF SPECIMENS: LEAN CLAY TRACE GRAVEL & SAND, DARK GRAY

LL 29 | PL 15 | PI 14 | Gs 2.7 EST. | SAMPLE TYPE: 3" SHELBY TUBE | TEST TYPE: CU

REMARKS:

MOHR'S CIRCLES DRAWN AT 2% STRAIN

SAMPLE WAS STAGE LOADED

* SECTION 10.2.2.1 METHOD A

PROJECT: I-74 CENTER SECTION
QUAD CITIES, IA/IL 07045052

BORING #: RW1105

SAMPLE #: B-3

DEPTH OR ELEV.: 4.0 TO 5.0 feet

LABORATORY: TERRACON - LENEXA | DATE: 2/18/2006

TRIAXIAL COMPRESSION TEST REPORT

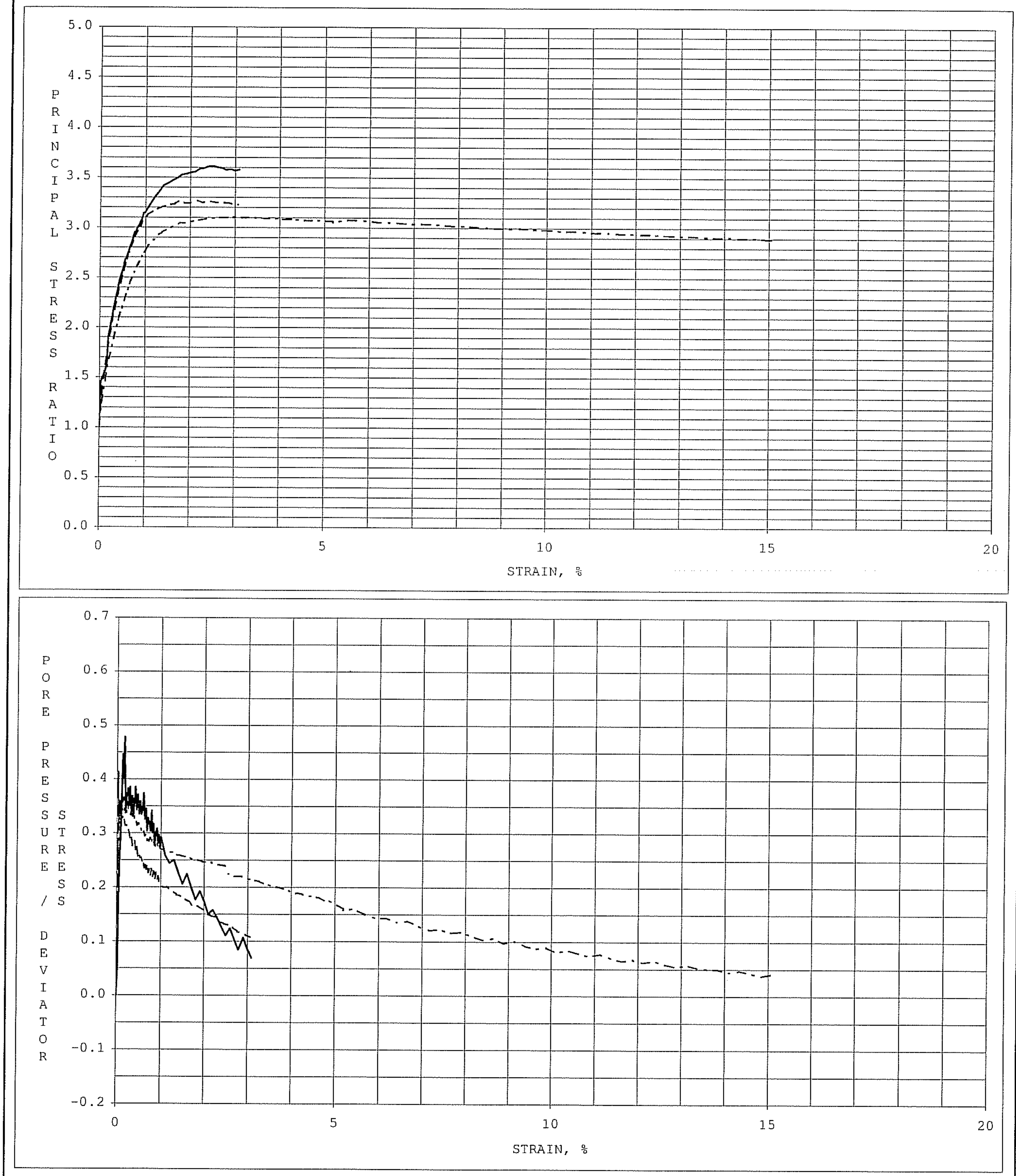
PROCEDURE: ASTM D4767, CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST ON COHESIVE SOILS (TERRACON MODIFIED FOR STAGE LOADING)

Terracon

C:\Documents and Settings\ECARRASC\My Documents\PROJECTS\Iowa\I-74\Central Section Iowa\Retaining Walls Design\Lab results\[07045052TriaxialCUStaged-RW1105-B3-4'.xls]REPORT

I-74 CENTER SECTION

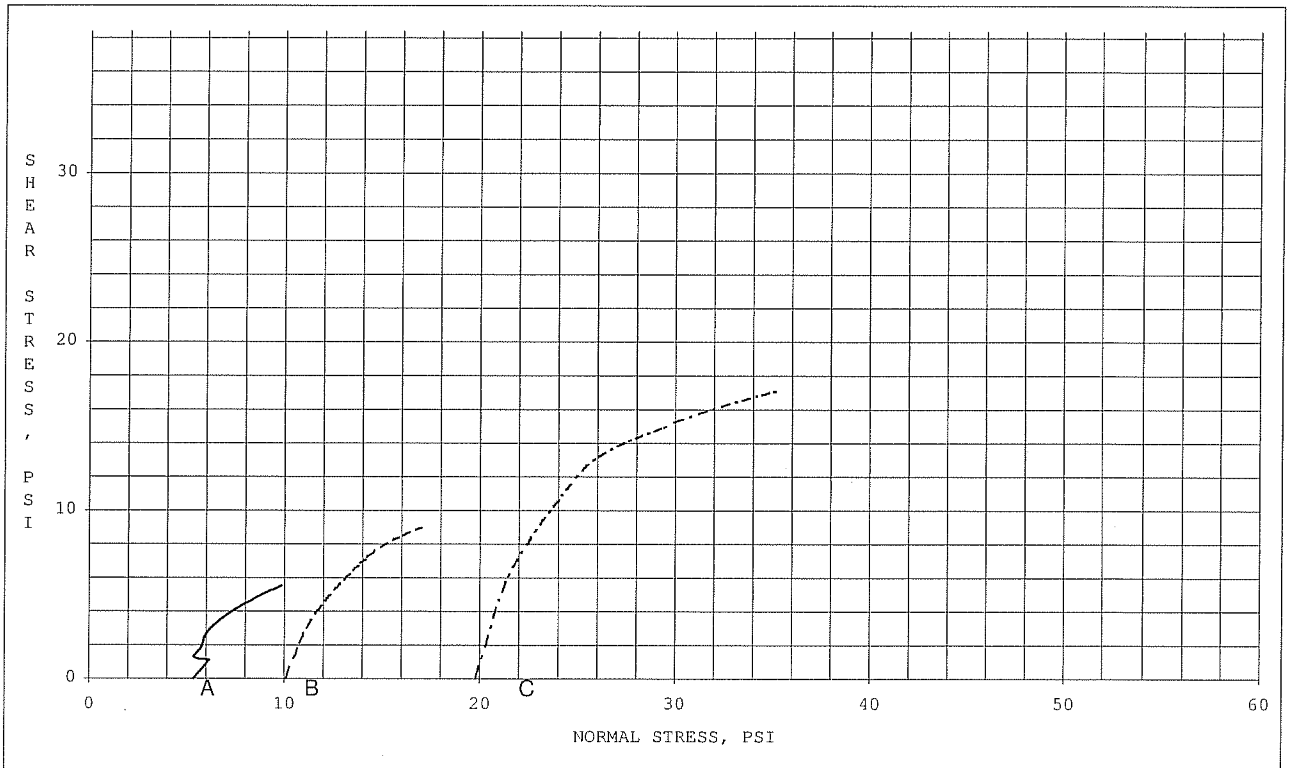
07045052 RW1105 4.0 TO 5.0 feet

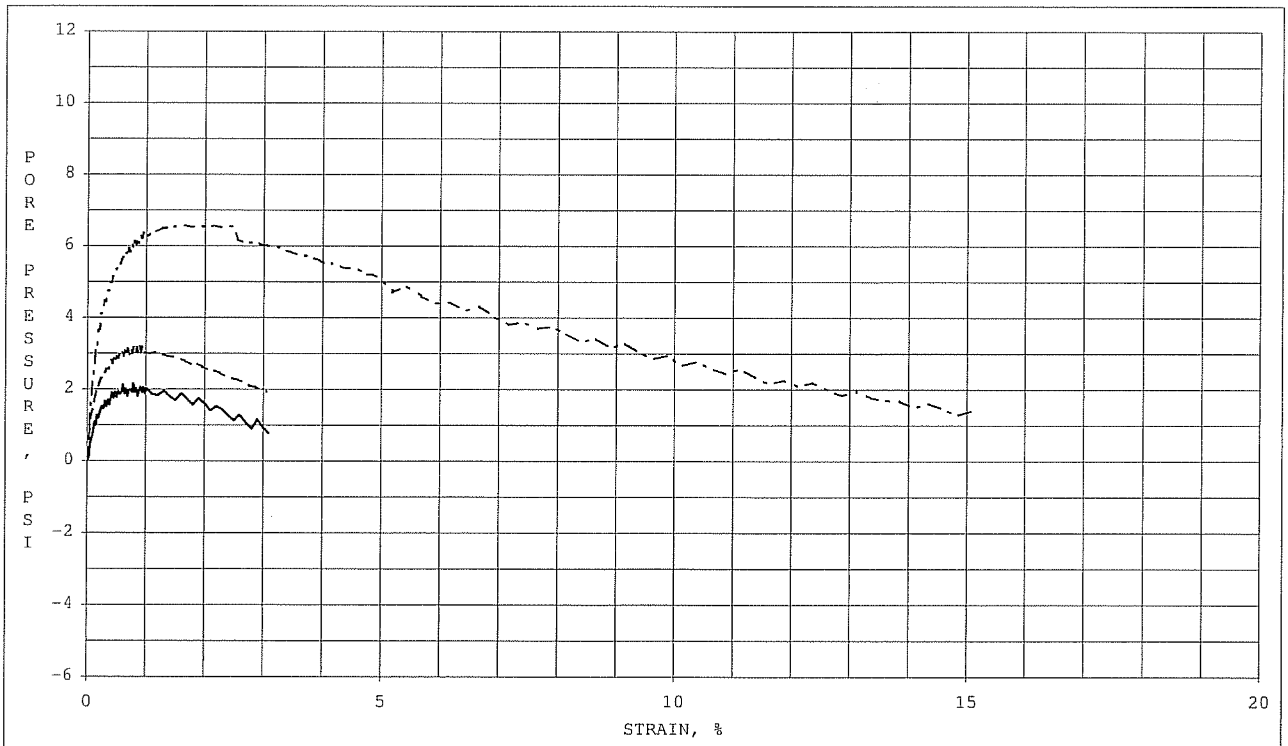


Terracon

I-74 CENTER SECTION

07045052 RW1105 4.0 TO 5.0 feet





Terracon

C:\Documents and Settings\ECARRASC\My Documents\PROJECTS\Iowa\I-74\Central Section Iowa\Retaining Walls Design\Lab results\[07045052TriaxialCUStaged-RW1105-B3-4'.xls]REPORT

Illinois Department of Transportation

Structure Geotechnical Report Responsibility Checklist

Structure Number: 081-6013 (prop.) ______ (exist.) Contract Number: ______ Date: 5/12/2008

Route: FAI Route 74 Section: 81-1-2 County: Rock Island

TSL plans by: CH2M HILL

Structure Geotechnical Report and Checklist by: CH2M HILL / Emmanuel Carrasco

IDOT Structure Geotechnical Report Approval Responsibility : ☐ Qualified District Geotechnical Personnel ☒ BBS Central Geotechnical Unit

Geotechnical Data, Subsurface Exploration and Testing

	Yes	No	N/A
All pertinent existing boring data, pile driving data, site inspection information included in the report?	☒	☐	☐
Are the preliminary substructure locations, foundation needs, and project scope discussions between Geotechnical Engineer and Structure Planner included in the report?	☒	☐	☐
All ground and surface water elevations shown on all soil borings and discussed in the report?	☒	☐	☐
Has all existing and new exploration and test data been presented on a subsurface data profile?	☒	☐	☐
Is the exploration and testing in accordance with the IDOT Geotechnical Manual policy?	☒	☐	☐
Are the number, locations, depths, sampling, testing, and subsurface data adequate for design?	☒	☐	☐

Geotechnical Evaluations

	Yes	No	N/A
Have structure or embankment settlement amounts and times been discussed in report?	☐	☐	☒
Does the report provide recommendations/treatments to address settlement concerns?	☐	☐	☒
Has the critical factor of safety against slope instability been identified and discussed in the report?	☒	☐	☐
Does the report provide recommendations/treatments to address stability concerns?	☐	☐	☒
Is the seismic design data (PGA, amplification, category, etc.) noted in the report?	☐	☐	☒
Have the vertical and horizontal limits of any liquefiable layers been identified and discussed?	☐	☐	☒
Has seismic stability been discussed and have any slope deformation estimates been provided?	☐	☐	☒
Has the report discussed the proximity of ISGS mapped mines or known subsidence events?	☒	☐	☐
Has scour been discussed, any Hydraulics Report depths reported & soil type reductions made?	☐	☐	☒
Do the Factors of Safety meet AASHTO and IDOT policy requirements?	☒	☐	☐

Geotechnical Analyses and Design Recommendations

	Yes	No	N/A
When spread footings are recommended, has a bearing capacity and footing elevation been provided for each substructure or footing region?	☐	☐	☒
Has footing sliding capacity been discussed?	☐	☐	☒
When piles are recommended, does the report include a table indicating estimated pile lengths vs. a range of feasible required bearings and design capacities for each pile type recommended?	☐	☐	☒
Have any downdrag, scour, and liquefaction reductions in pile capacity been addressed?	☐	☐	☒
Will piles have sufficient embedment to achieve fixity and lateral capacity?	☒	☐	☐
Have the diameters & elevations of any pile pre-coring been specified (when recommended)?	☐	☐	☒
Has the need for test piles been discussed and the locations specified (when recommended)?	☐	☐	☒
Has the need for metal shoes been discussed and specified (when recommended)?	☐	☐	☒
When drilled shafts are recommended, have side friction and/or end-bearing values been provided?	☐	☐	☒
Has the feasibility of using belled shafts been discussed when terminating above rock, or have estimated top of rock elevations been provided when extending into rock?	☐	☐	☒
Have shaft fixity, lateral capacity, and min. embedment been discussed?	☐	☐	☒
When retaining walls are required, has feasibility and relative costs for various wall types been discussed?	☒	☐	☐
Have lateral earth pressures and backfill drainage recommendations been discussed?	☒	☐	☐
Has ground modification been discussed as a way to use a less expensive foundation or address feasibility concerns?	☐	☐	☒
Have any deviations from IDOT Geotechnical Manual or Bridge Manual policy been recommended?	☐	☒	☐

Construction Considerations

	Yes	No	N/A
Has the need for cofferdams, seal coat, or underwater structure excavation protection been discussed?	☐	☐	☒
Has stability of temporary construction slopes vs. the need for temporary walls been discussed?	☐	☐	☒
Has the feasibility of cantilevered sheeting vs. a temporary soil retention system been discussed?	☐	☐	☒
Has the feasibility of using a geotextile wall vs. a temp. MSE for any temp fill retention been noted?	☐	☐	☒

"In order to aid in determining the level of departmental review, please attach additional documentation or reference specific portions of the SGR to clarify any checklist responses that reflect deviation from IDOT policy/practice."